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*Special Issue:
Achieving Software Quality*

COVER STORY

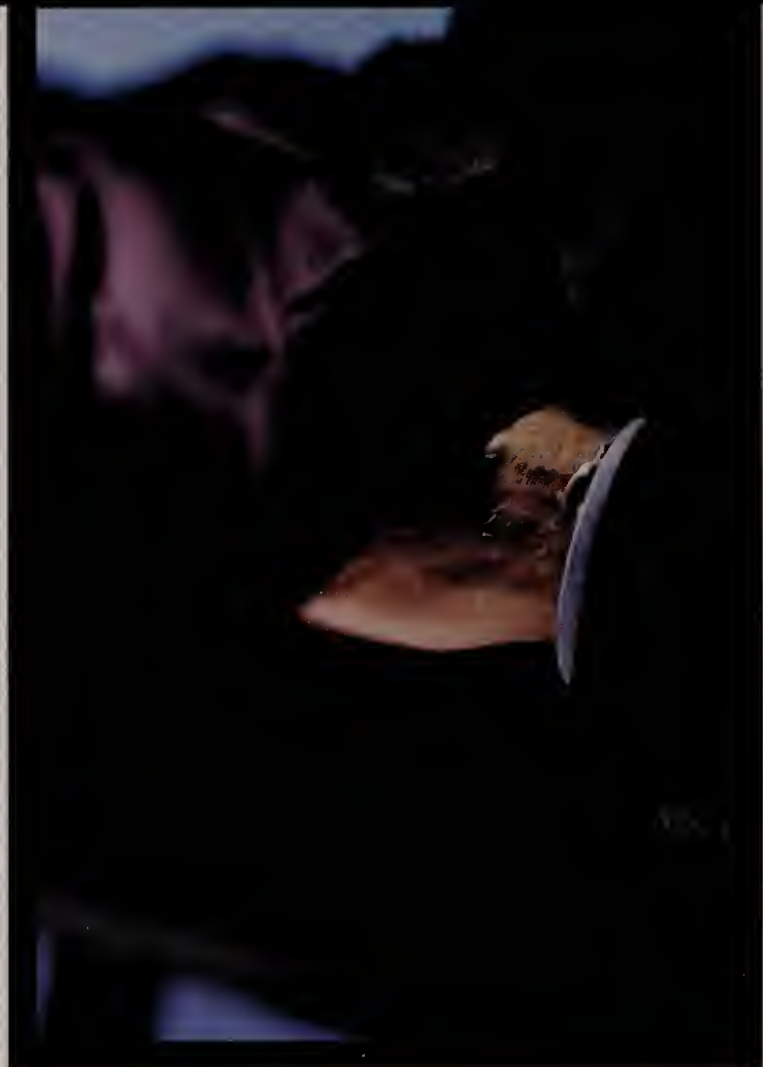
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CIO

VOLUME 8, NUMBER 9

SPECIAL ISSUE

CLIENT/SERVER SKILLS



32

Beating the Bushes

In the transitional world of client/server architectures, there may be no single best solution to the daunting problem of finding expert programming help. The best hope is to pick from a patchwork of inside, outside, off-the-shelf and hybrid strategies.

By John P. Mello Jr.

Help
wanted
32



APPLICATION DEVELOPMENT

40

Out-of-this-World Software

The space shuttle's onboard-systems team proves that error-free programming may be tough to achieve, but it isn't rocket science.

By E.B. Baatz



Five-star
software 40
Cover photo by
Rocky Kneten

END-USER SUPPORT

50

Sharing Power Safely

If the growing pains of adjusting to end-user empowerment are inevitable, perhaps the suffering can be kept optional. How best should a CIO provide users with useful tools and applications so that their access to corporate data resources will be productive and not disruptive?

By Megan Santosus

Divvying up
the data pie
50



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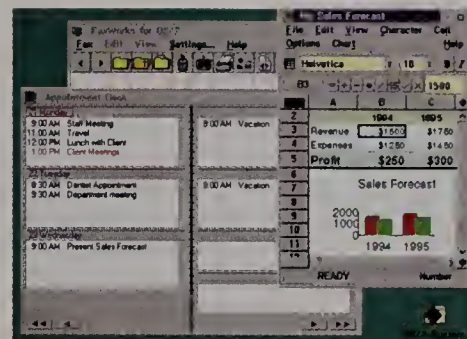
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SPECIAL ISSUE (CONT.)

ROUNDTABLE

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Talking About an Evolution

Just about every company today has either switched to client/server or is planning to. Embracing the architecture successfully requires a marked shift not only in the technology involved but also in the way a company plans, develops and implements its systems. Here, a panel of experts discusses what it takes to make it work.

By Mickey Williamson



*Shifting
gears*
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*The road to
maturity*
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COLUMNS

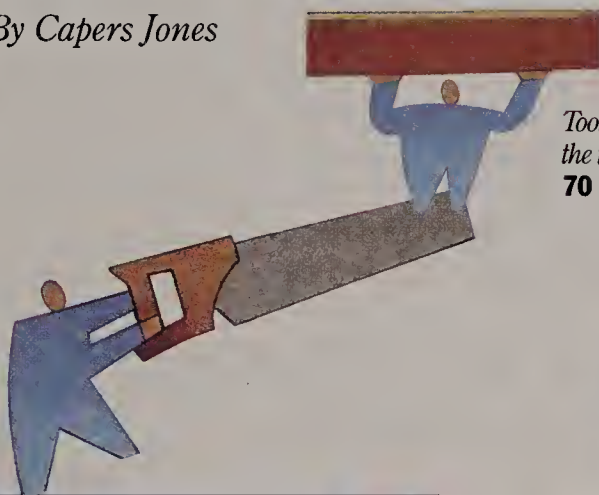
SOFTWARE QUALITY

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INSIGHTS: QUALITY QUEST

With client/server application-development techniques still emerging, quality-control standards aren't as stringent as they might be. Adopting quality tools and more-structured development methodologies can help keep client/server maintenance costs—not to mention user dissatisfaction—in check.

By Capers Jones



*Tools of
the trade*
70

CLIENT/SERVER MANAGEMENT

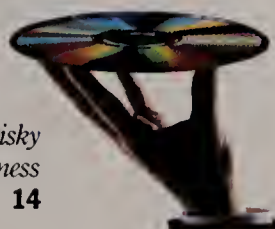
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STATE OF THE ART: THE NETWORK TOOLBOX

The growth in both size and complexity of enterprisewide client/server networks increases the need for a comprehensive and uniform set of management tools.

By John Edwards

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business*
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Creating mission-critical client/server applications may be in the forefront of the thoughts of information executives these days, but the quality of software—regardless of the tools used to create it—also remains a hot topic in the IS domain. This special issue devoted to software addresses both concerns.

In her article, "Out-of-this-World Software," beginning on Page 40, Senior Writer E.B. Baatz takes a close look at what it has taken for Loral Corp.'s Space Shuttle Primary Avionics Software System team to qualify for a coveted level-five quality rating from the Software Engineering Institute at Carnegie Mellon University.

So far, only two companies have claimed to achieve level-five status. Yet their successes hold much interest for CIOs because their methods could apply to all programming groups. The metrics involved not only make software development predictable, they also make it possible to calculate the cost of quality.

While the model is drawing interest from IS quarters, making the right moves in the client/server fray is another major concern for information executives. Our roundtable, featuring representatives from the CIO, consultant and vendor communities, addresses the topic from various perspectives. (Please see "Talking About an Evolution," beginning on Page 60.) Our participants agree that every client/server project becomes a systems-integration project. After all, as one panelist points out, IT vendors don't collaborate to make sure their products work together before putting them on the market.

Although our roundtable participants stress the importance of training in the client/server environment, Contributing Writer John P. Mello Jr. examines the various strategies for finding expert-programming help to create the client/server applications necessary for the enterprise. (Please see "Beating the Bushes," beginning on Page 32.)

Despite all the concern with quality and client/server development, the bottom line and usage still rest with the people who use those applications, according to Senior Writer Megan Santosus. (Her article, "Sharing Power Safely," begins on Page 50.) She reports that end users aren't overly concerned with the dynamics and the politics of what makes for good applications; what they really want is to use information productively.

The difficulties of creating high-quality software still keep information executives awake at night. Finding the resources to cope with this never-ending nightmare is an ongoing challenge.

Marcia Blumenthal



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Being topical and innovative in business requires a constant infusion of fresh ideas and a person with vision to stay one step ahead of the paradigm. This is especially true in an industry such as magazine publishing, which is evolving particularly rapidly because the vehicle to reach readers is changing, no longer consisting of just paper and ink. Publishing companies are taking full advantage of cyberspace and CD-ROM technology to disseminate information.

To ensure *CIO*'s role in this high-tech future and to capitalize on the innovative ideas of the *CIO* staff, I have asked John Whitmarsh, a man of vision and creativity, to join us here at CIO Communications. With 23 years of newspaper and magazine experience, John will undoubtedly have a positive impact. As of Jan. 3, we officially welcomed him into the family as editorial director of *CIO* Magazine.

John will also be instrumental in extending *CIO*'s global coverage. Under his leadership, our publication will speak a language everyone understands: increasing business value through technology. Profiles of American companies with worldwide operations, as well as non-U.S. companies that have successfully exploited technology for bottom-line profit, will be featured increasingly in future issues.

You can expect great things coming out of *CIO* in the next few years. John's charter is to bring you the information you need in the most effective, efficient way possible. And with an outstanding crew of writers and editors behind him, *CIO* promises to continue to fulfill its ongoing commitment to editorial excellence.

John looks forward to meeting you at upcoming *CIO* and industry events and to working with you in the future.

John L. Whitmarsh

P.S. Plan early! Make your conference reservation for the CIO European Symposium, to be held June 7-9 in Brussels, Belgium. This international forum gives you the opportunity to explore and evaluate global IT management issues. For more information, please call 800 355-0246.

Coming In CIO

Workers in Progress

A few years ago, workers expected to spend their entire careers with one company, exchanging loyalty and performance for security. But with downsizing, restructuring, mergers and other massive changes, that's no longer the case. Some say the focus must change from employment to employability—that is, developing the skills to find work anyplace, anytime—and that companies must help create a career-resilient workforce, even with the risk of having those skilled employees jump to a competitor's payroll.

Just Say No?

Saying no to users is something no one in IS wants to do. But sometimes it's necessary. And with user clout increasing, CIOs must find new ways to do it to avoid getting into trouble themselves. We'll present a number of CIOs' strategies for keeping problematic user requests to a minimum, and for saying no when they have to without resorting to that politically incorrect two-letter word.

The View from The Other Side

How do executives learn about technology? Do they get most of their IT information from the internal IS group? Do they attend outside seminars and classes? Do their peer groups keep them up to speed on technology issues? We'll explore these questions and others to provide some insight into the different constituencies that the IS department serves.

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TRENDLINES

CLIENT/SERVER INTEROPERABILITY

ALL TOGETHER Now

With so many vendors competing for market share in the client/server platform, often with opposing business strategies, plug-and-play interoperability may seem a quixotic quest. But user groups are making some significant strides toward that end.

Shortly after its launch in 1991, the Open User Recommended Solutions (OURS) group, based in New York, set out to determine which client/server products work together. Ascertaining "W4" (what works with what), as new Chairman John Danielsen describes it, proved to be an overwhelming task that had to be broken down into components. Since then, the group, made up of IS personnel from over 60 major companies, has sharpened its focus.

The group's primary concern is "how to make client/server systems as robust, secure and easy to use as the mainframe environment," Danielsen says. That goal encompasses a wide range of subjects, but OURS focuses on specific issues and then makes recommendations to vendors based on its membership's needs.

The group's licensing task force, for example, has worked out guidelines amenable both to customers

and to some major vendors—notably, IBM. In fact, Big Blue adopted the group's recommendations into its standard licensing agreement last spring. The guidelines can be significant time-savers, particularly for companies like Pacific Gas & Electric, where Danielsen works, which can spend \$50 million a year on licensing.

"We give [vendors] a copy of our software-licensing task-force report," he says. The report defines a number of terms, and "we expect

them to use these terms as we do."

OURS' data-security task force planned to release a report last December aimed at developing a single, standard sign-on for all applications on a network. Other task forces are working on data-security issues and requirements for firms developing a client/server object-oriented migration plan. Among OURS' other priorities: client/server network management such as directory and authentication services, elec-

tronic software distribution, fault management and configuration management.

Though elusive, the goal of plug and play is well worth the effort, Danielsen says. "Interoperability is one of the most important things I can do for my company in terms of IT cost [and usability]."

Other groups are also pushing hard for the goal. The Network Applications Consortium, for example, released a white paper last summer asking for interoperability among four messag-

DOS Equus

A serious horse gambler consumes information about thoroughbreds as voraciously as a Wall Street broker does about stocks; both seek data that can give an edge to pick a winner. Already ubiquitous on Wall Street, IT is now infiltrating the world of thoroughbred horse racing.

When analyzing a race, handicappers have traditionally pored through statistics in the *Daily Racing Form*, a horse-racing newspaper that has been a fixture at tracks for about 100 years. But now some 3,000 horse-track patrons use a computer bulletin-board system that lets them access and manipulate in numerous ways the same data that's found in the *Racing Form*. The service, Axcis Information Network Inc.'s TrackMaster, helps bettors wade through reams of equine data: how long since the horse last raced, wins vs. starts, odds, power ratings and the like.

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least, that's what they tell us," says Malcolm Kaufman, president of Axcis in Santa Clara, Calif. But the company doesn't promise that TrackMaster will make anyone rich. "We don't tell people how to bet. We just show the match-ups better," says Kaufman.

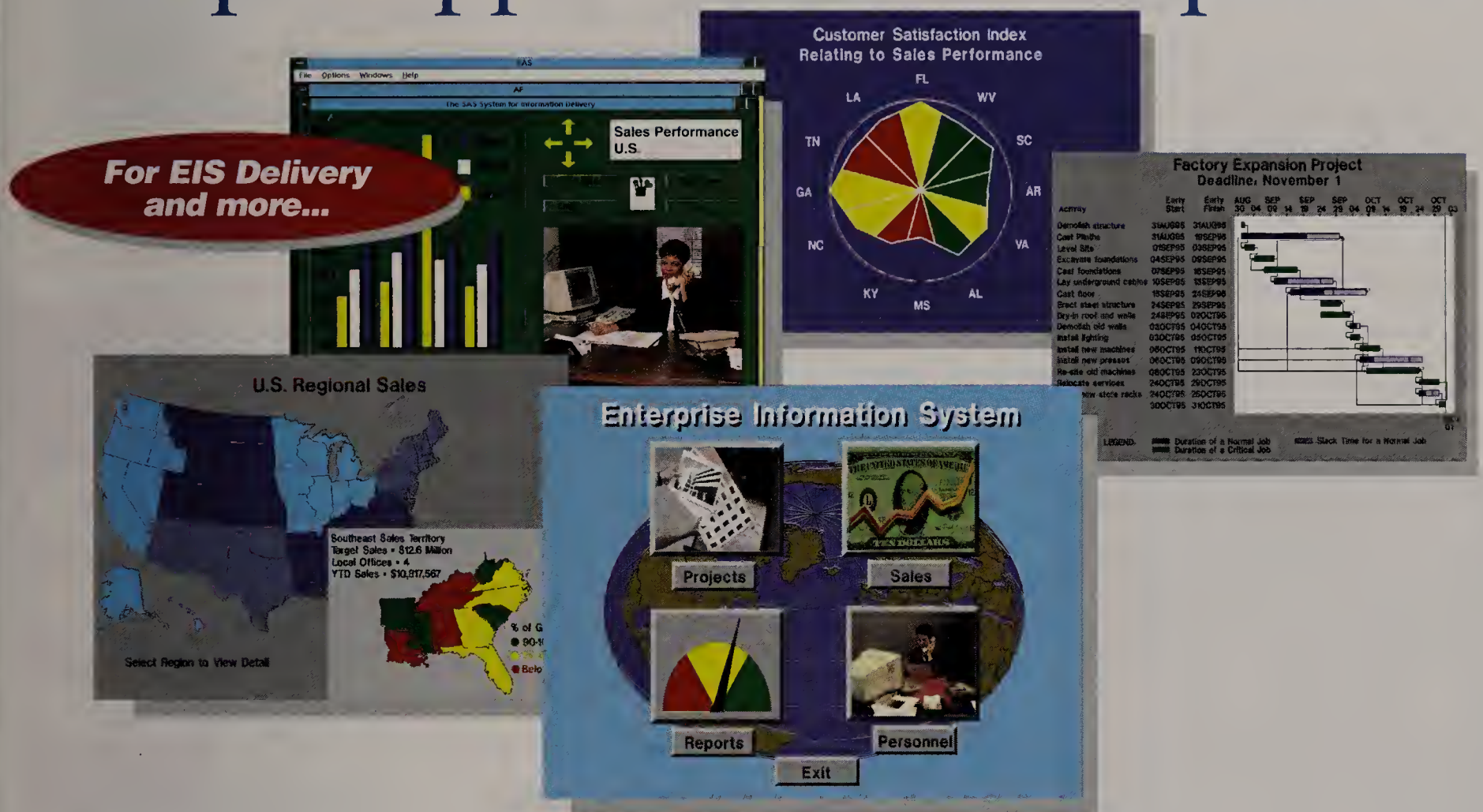
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TRENDLINES

ing vendors: Microsoft, Novell, Lotus and Banyan. The four companies indicated a willingness to cooperate on directory services, but it's

uncertain how much further they will go.

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—Peter Fabris

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The product is available in stores for \$79.95. For more information, call 800 964-1518. ■



CYBERSPACE INVADERS

A forthcoming book on gang wars in cyberspace has provoked an electronic attack on its author, according to a recent article in *The Wall Street Journal*. Alleged subjects of the book, Joshua Quittner's *Masters of Deception: Gang Wars in Cyberspace*, recently broke into computer systems run by Sprint, IBM and Pipeline, used them to seize control of the author's phone line and voice mail, and bombarded his e-mail account with thousands of messages. An excerpt describing the two "cybergangs," the Masters of Deception and the Legion of Doom, was published in *Wired* magazine, which also received about 1,000 messages. Sprint was forced to shut down several computers for about four hours to restore order. ■

THE DISTRIBUTIVE PRINCIPLE

Few companies today don't have at least a plan that mentions client/server somewhere (see "True Believers," Page 20), but for most, distributed databases

still don't figure prominently in any strategy. According to a recent report from Forrester Research Inc., of Cambridge, Mass., distributed databases are playing only a minor role in shaping the overall database

direction of Fortune 1000 firms.

Forrester interviewed senior IS managers at 50 such companies and found that

only 52 percent had a high-level strategy for distributed databases. The companies interviewed were considering the technologies or were in the very early stages of implementation.

Forrester argues that organizations must tap dispersed databases in order to realize the benefits of client/server. Its report, *Weaving the Dataweb*, describes how organizations can cost-effectively take control of distributed databases by developing a "dataweb" of interdatabase connection technologies.

"Companies that don't get moving and harness the power of distributed databases will lose in a big way," says Bobby Cameron, senior analyst in Forrester's Software Strategy Service and author of the report. "Users won't realize the client/server benefits they expect—and desperately need," he adds.

For more information, call 617 497-7090. ■

CAMERA SHY

Ninety-seven percent of business executives are comfortable with fax machines, according to a survey by Sprint Corp., but only 20 percent feel equally relaxed with videoconferencing.

—Investor's Business Daily

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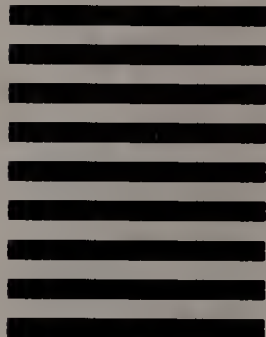
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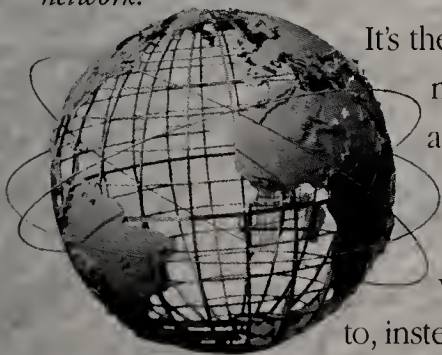
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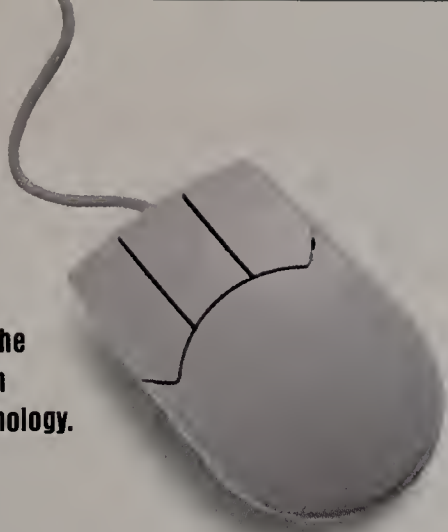
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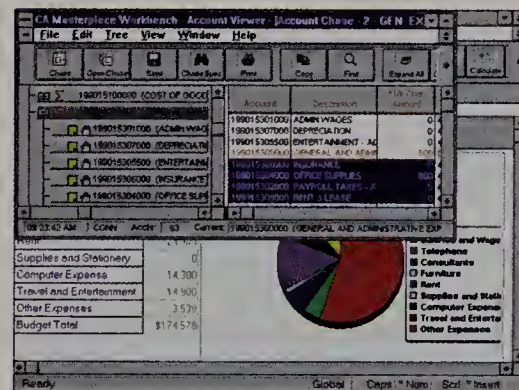
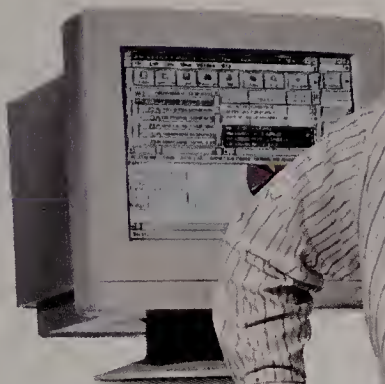


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TRENDLINES

CLIENT/SERVER SURVEY

TRUE BELIEVERS

IS executives talk about client/server much the way Republicans talk about their new dominance in Congress: as both a challenge and an opportunity. And according to a recent survey of *CIO* readers, it's a challenge many are already tackling, in hopes of making their organizations more information-friendly places.

18 months. And those adopting the strategy are doing so wholeheartedly: Nearly half of the respondents (47 percent) whose firms have implemented client/server are doing it enterprisewide.

Once it's been established that everybody's doing it, the next logical question is, why? Respondents gave as their three top reasons the ability to access information in a timely fashion (80 percent), flexibility (64 percent) and the perceived cost-effectiveness of client/server technology (45 percent).

Where client/server was not an immediate concern, respondents said that insufficient user need (53 percent) and high implementation costs (41 percent) were keeping them off the bandwagon.

Not surprisingly, the most frequently mentioned usage for client/server among companies with systems in place was "to allow end users to access mission-critical

information from their desktop systems" (64 percent). Of growing importance was giving end users the ability to program and customize their own reports; while only 43 percent of respondents are doing that now, 57 percent expect to do so in the near future.

The *CIO* study not only asked respondents what they were doing, but what they were doing it on. For client systems, 486 (94 percent) and 386 (69 percent) PCs were cited most frequently, and 66 percent of respondents said they will likely in-

Client/Server's Appeal

Percentage of 445 CIO subscribers responding

- 80%**
Ability to access information in a timely fashion
- 64%**
Flexibility
- 45%**
Cost-effective
- 44%**
Standard user interface
- 42%**
Allows end users to program custom reports

ning on PC or workstation servers, while in the mini-computer and mainframe worlds, Unix (43 percent), MVS (33 percent) and VMS (29 percent) dominated.

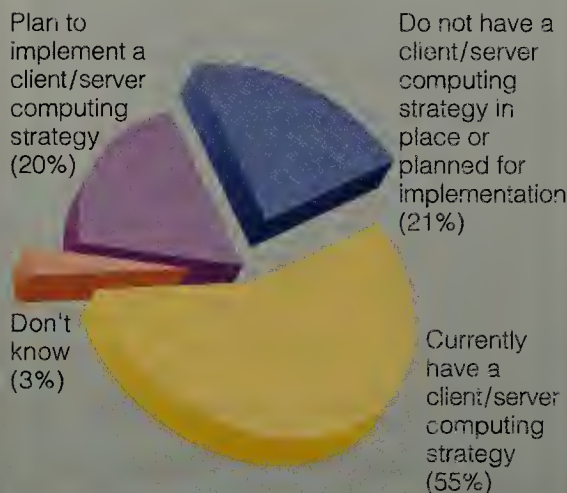
Ethernet was far and away the most popular technology for establishing links between clients and servers, with 80 percent of respondents reporting current usage. TCP/IP was the top network protocol, cited by 62 percent of respondents.

Organizations with systems in place reported on average that 25 percent of their applications were running on client/server and that the number would nearly double in 18 months. The most popular applications were accounting/finance (48 percent), project management (37 percent) and messaging (37 percent); human resources/personnel/payroll and document management were expected to become more pervasive soon.

As for client/server databases, Microsoft and Oracle had the largest share of respondents' business (39 percent and 37 percent, respectively), although for planned purchases, Oracle beat out Microsoft 36 to 23 percent. ■

Penetration of Client/Server

Percentage of 607 CIO subscribers responding



The survey was conducted by International Data Group Research Services of Framingham, Mass., for CIO Communications, the publisher of *CIO* magazine (both companies are owned by the same parent corporation). More than 600 subscribers participated, and their responses suggest that companies have recognized the appeal of client/server and are busily translating it into concrete projects. Indeed, 75 percent of respondents either have a client/server strategy in place or plan to implement one in the next

stall Pentium PCs in the near future. Predictably, the most common operating system was DOS with Windows (90 percent), although 47 percent indicated that their organizations would eventually use Chicago.

The top three types of servers mentioned were 486 PCs (76 percent), minicomputers (41 percent) and mainframes (26 percent). In addition, 61 percent of respondents plan to install Pentium PCs as servers in the next 18 months. Novell NetWare (69 percent) and Unix (48 percent) were the top two operating systems run-

Applications on Client/Server

Top Mentions

Currently Running

Percentage of 318 CIO subscribers responding

- Accounting/finance.....(48%)
- Project management.....(37%)
- Messaging applications.....(37%)
- Customer service.....(34%)
- Document management.....(33%)

Planned for Implementation

Percentage of 385 CIO subscribers responding

- Accounting/finance.....(51%)
- Human resources/personnel/payroll.....(40%)
- Document management.....(39%)
- Customer service.....(36%)
- Imaging.....(35%)



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TRENDLINES



CELL DIVISION

Mention cellular technology, and most people think of mobile phones and wireless networks. But now it is being used to transport video as well: Bell Atlantic Mobile, of Bedminster, N.J., and a Washington cable-TV station have announced a new system that allows video news footage to be transmitted over a cellular network. The result: Broadcast-media personnel reporting on location can "call in" their stories to the office much the way print journalists long have.

Traditionally, TV news crews have had to transport video material by vehicle or transmit by satellite. Using the new system, they convert videotapes to digital format, then transmit the footage via the Bell Atlantic cellular network directly to the newsroom. Transmission costs a fraction of what it does using satellites, and there is no need to wait until video can be "uplinked" for satellite transmission.

Washington's Newschannel 8 is using the system, and Bell Atlantic foresees other applications in videoconferencing and education. ■

OFF THE SHELF

THE POLITICS OF INFORMATION MANAGEMENT

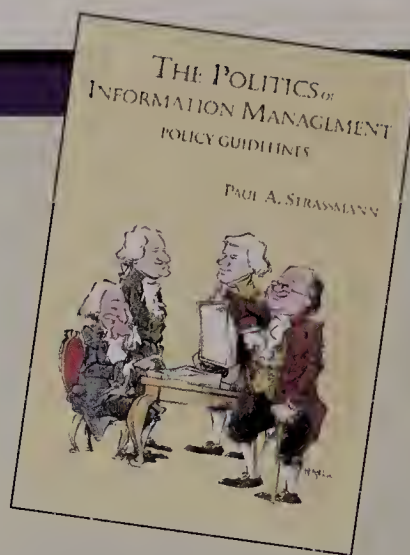
POLICY GUIDELINES

By Paul A. Strassmann
The Information Economics Press
(New Canaan, Conn.),
1995

523 pages, \$49

Devotees of management gurus Tom Peters and Michael Hammer take a few hard knocks in Paul A. Strassmann's book, *The Politics of Information Management*. So do CIOs who don't focus on technology and CEOs who don't set information-management policies. But lest one think that this latest book by Strassmann, who is also the author of *The Business Value of Computers* (The Information Economics Press, 1990), is just another cranky indictment of IS managers and their consultant cohorts, the book does have much to offer practitioners in today's politically charged corporate IT climate.

That Strassmann takes a dim view of much of the current business rhetoric is clear from the start. He writes, "Lurking behind much of the networking, integrating, downsizing, reengineering and client/server talk are unreformed technocrats who keep speaking in the language of technology instead of the more controversial dialect of power politics." But behind the technobabble, a battle is being waged. "Managing information



systems is primarily a matter of politics and only secondarily a matter of technology," writes Strassmann. Because systems are the backbone for delivering information to the masses—or, in an elite society, to the few—whoever manages them gets pitched into sometimes overt, often subversive power struggles. It's these shifting political winds that blow many companies off course in their IT investments, make payoffs hard to realize and cause CIOs to have such a short average job tenure, according to Strassmann. The solution, he says, is for CEOs and executive management to take charge of the technology rudder, set direction and establish corporate information policy.

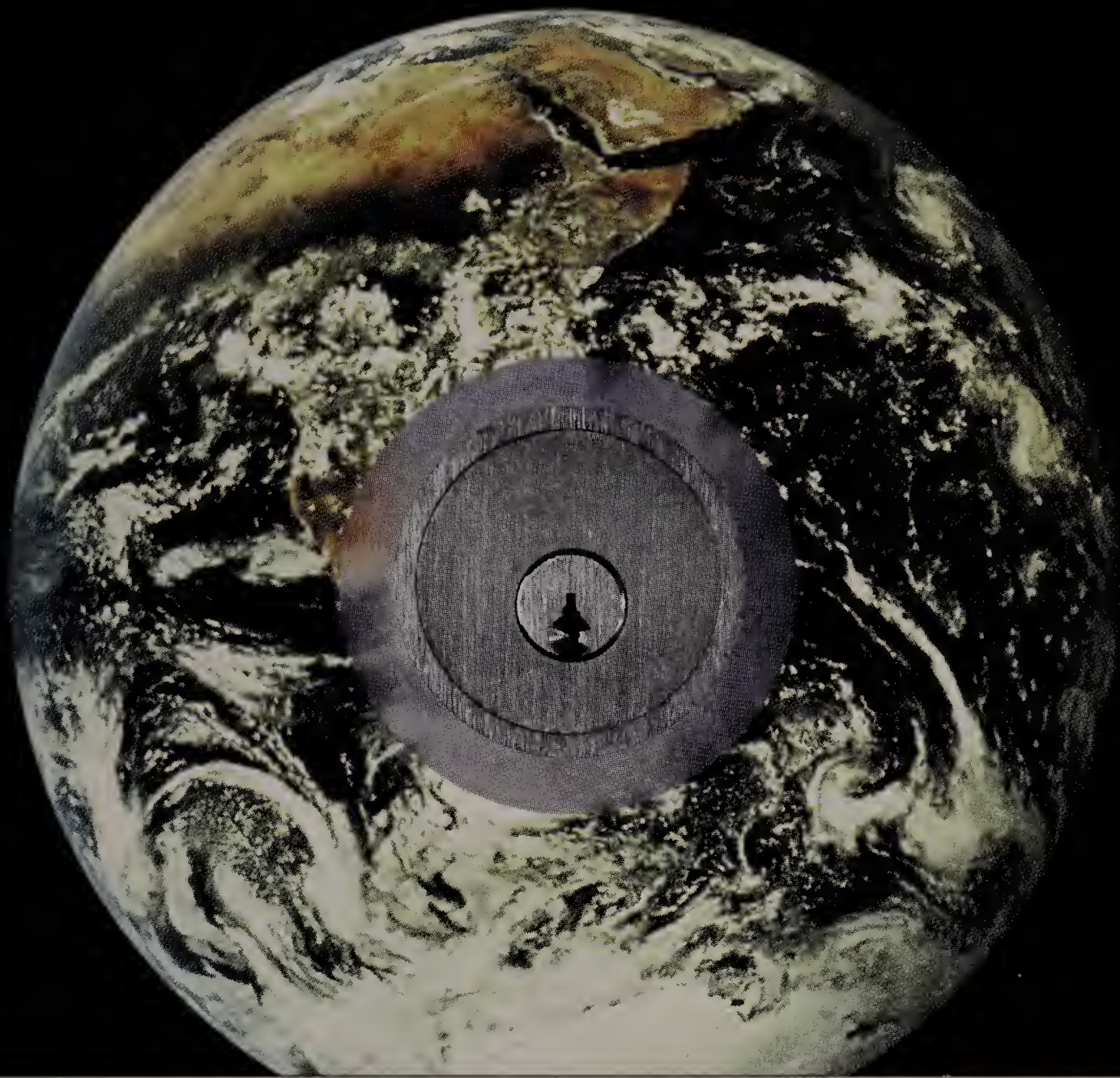
In the first 100 pages of his book, Strassmann lays out the politics of information management and suggests that the best model for setting information policy is the U.S. Constitution. Born in Eastern Europe, Strassmann has a deep respect for the American democratic system. That, along with his obviously erudite reading habits and his three decades of work as an IT executive in U.S. companies, makes him a

compelling spokesman for this "federalist" model of corporate governance. A corporation, argues Strassmann, is a federation that can be effectively governed using an information constitution that is untouched by changes in management. In such a federation, power is balanced among a central authority (the CEO and senior executive staff) and a number of constituent political parts (the operating units and corporate services like IS). In Chapter 11, Strassmann lays out a mock constitution for information management that, by itself, makes the book a worthwhile investment.

While the book loses much of its force about a third of the way through, the reader is encouraged to forge—or at least skip—ahead. Several later chapters are still insightful and thought-provoking, notably those on reengineering efforts and the political trouble that awaits CIOs who lead them, and sections that explore management roles and the CIO's job.

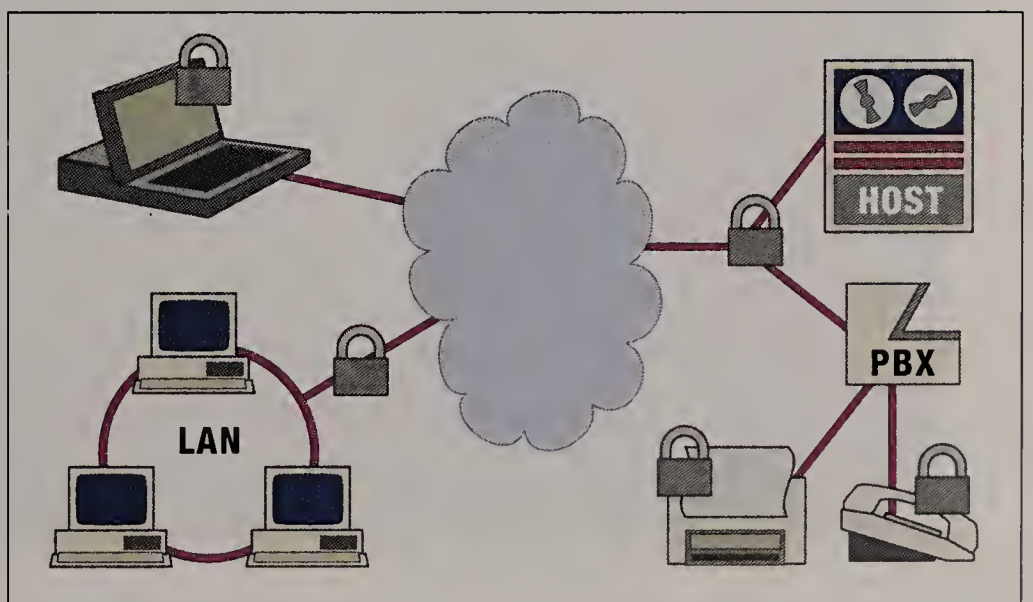
The Politics of Information Management is too long, sometimes unfocused, and its intended audience is not always clear. In addition, Strassmann is stingy with real-life examples to substantiate his arguments, and the goofy cartoons that dot the text do more harm than good. But for the excellent exploration of corporate governance and information policy, the book is a must read for all officers of the modern corporation.

—E.B. Baatz



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Quality Quest

With client/server application-development techniques still emerging, quality-control standards aren't as stringent as they might be. Adopting quality tools and more-structured development methodologies can help keep client/server maintenance costs—not to mention user dissatisfaction—in check.

BY CAPERS JONES

No young technology is perfect when it first appears, and client/server is no exception. Client/server tool vendors and developers must address several key problems.

First, not only are client/server quality levels suspect, but development methodologies are immature. Further, data consistency among applications is questionable. And while maintenance costs are essentially unknown today, they may be steep.

As the client/server saga unfolds, here are some general observations:

- Since client/server applications are usually new, they don't have a long history of data on quality. Preliminary quality data collected since 1990 by Software Productivity Research Inc. (SPR) is alarming and indicates a need for pre-test inspections and better quality control. Compared with how mainframe applications have been built, the methodologies for client/server software development can only be characterized as immature. Much more rigor is needed.

- How client/server applications will affect corporate data administration, data dictionaries and repositories is still unclear; initial findings are somewhat ominous. It is hard to escape the conclusion that client/server applications are starting to suffer from inconsistent data definitions, unique or quirky data elements and carelessness in data design.

- Most client/server applications are brand new today, but they won't be in 1999. The cost to maintain them when they become aging legacy systems is an important but unpredictable variable. It may be that outright replacement of aging client applications becomes common, but this is not as likely on the server side. The whole issue needs study.

Origins of Quality Problems

Unlike standalone PC applications, client/server projects involve multiple computers, networks or linkages between mainframes and PCs, and a lot of sharing and synchronization of the data residing in the server. Compared with older, monolithic application development, client/server development is more complex and operational complexity is greater.

Despite this complexity, however, client/server development practices are often less formal than those followed for older, mainframe applications. For example, formal inspections of specifications and source code are less common. The combination of higher complexity levels and less-rigorous development practices has a dual impact: client/server quality is often deficient, and in the long term, client/server maintenance costs may well exceed those of traditional mainframe applications.

Although the data is still far from complete and has a high margin of error, comparisons of SPR's long-range studies of all the bugs found during



Zen and the Art of Networking

Life is suffering.



All things are transient.



The future is an illusion.



And there is one path to Nirvana.



reviews, inspections, testing and maintenance of client/server and monolithic mainframe applications suggest that the former are decidedly buggier. The overall defect potential, or the probable total number of latent bugs in delivered software, is 5.5 defects per function for client/server applications versus 4.5 for mainframe applications. (See table.)

Requirements defects are approximately equal for mainframe and client/server applications, but the similarities end there. Because of the greater complexity of distributed software, the design defect rate for client/server applications is 40 percent higher than for mainframe applications; client/server's code defect rate is 14 percent higher than mainframe's. Bad fixes (secondary defects or bugs accidentally introduced into software while fixing other bugs) are 50 percent more prevalent in client/server applications than in mainframe programs. The implications for long-range maintenance costs of client/server applications are not good.

Even more troublesome than the elevated defect potentials are the somewhat lower defect-removal efficiency rates, which reflect the combined effectiveness of all reviews, inspections and tests carried out on software before delivery. For example, if a total of 90 bugs are found during the development of a software product and its users subsequently find and report 10 bugs, then the defect-removal efficiency for this project is 90 since 90 out of 100 bugs were found before release.

The average defect-removal efficiency for monolithic mainframe applications has been about 85 percent. (Best-in-class companies top 95 percent.) To date, the defect-removal efficiency rate in the client/server domain appears to be under 80 percent, though the data on this point is very sparse and has a high margin of error.

When the mainframe defect potentials of about 4.5 bugs per function point are reduced by 85 percent, the approximate quantity of delivered defects averages about 0.675 defects per function point. For distributed client/server applications,

the higher defect potential of 5.5 bugs per function point interacts in an alarming way with the reduced removal efficiency of 80 percent. The resulting defect-delivery level of about 1.1 defects per function point is uncomfortably close to double the typical number of defects latent in mainframe software.

Improving Client/Server Quality

The same kinds of methods, tools and approaches that have long been used by best-in-class software producers can also be used with client/server

All of the best-in-class software producers such as AT&T, Hewlett-Packard, Microsoft, IBM, Raytheon and Motorola use pre-test design reviews as well as formal code inspections. Both can make notable improvements in defect-removal efficiency.

As for quality tools, any or all of the following have a useful place: quality- and defect-estimating tools; defect-tracking and -measurement tools; complexity-analysis tools; design- and code-inspection support tools; prototyping tools; code-re-

Software Defect Pattern for Monolithic Mainframe and Client/Server Applications

(Defects per Function Point)

	Requirements Defects	Design Defects	Code Defects	Bad Fixes	Overall Defect Total
MAINFRAME APPLICATIONS	1.00	1.25	1.75	0.50	4.50
CLIENT/SERVER APPLICATIONS	1.00	1.75	2.00	0.75	5.50

SOURCE: SOFTWARE PRODUCTIVITY RESEARCH INC., 1994

applications. These approaches can be summarized in terms of defect-prevention methods, defect-removal methods and quality tools.

Among the defect-prevention approaches that work with client/server applications, the concept of joint application design, or JAD, can be very useful. Joint development of requirements by the client and the software group reduces the rate of unplanned creeping requirements and decreases the number of defects in the requirements themselves.

Also effective in preventing defects are rapid application development (RAD), prototyping, reusable components, some aspects of information engineering (IE), and a variety of rigorous specification approaches such as the Warnier-Orr method and the Yourdon methods. Structured programming and coding approaches are also helpful. Although it takes several years to reach full power, a quality-measurement program is also very effective.

Testing alone has never been sufficient to ensure high quality levels.

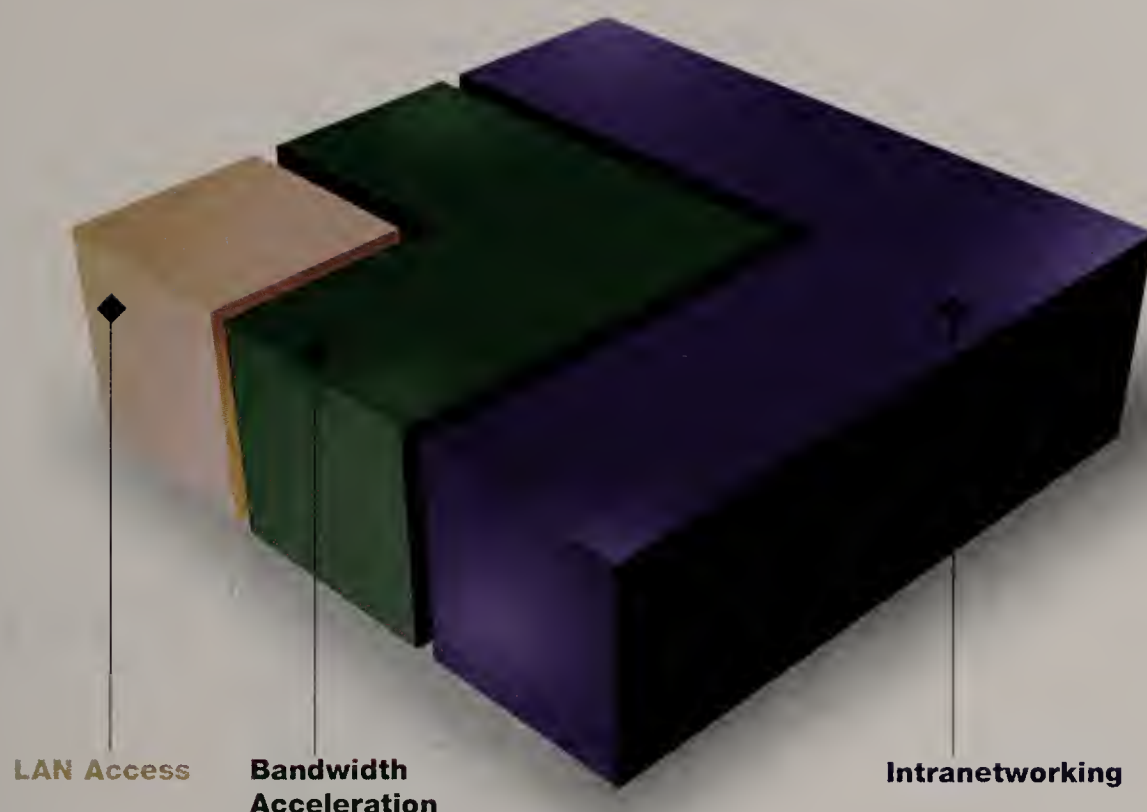
structuring tools; configuration-control tools; record/playback test support tools; test-coverage analysis tools; and test library control tools.

Some of these tools are now being integrated as part of CASE tool suites. However, many CASE tool vendors have not yet provided adequate support for quality control. Be cautious of vendor claims for "full life-cycle support" if quality is not part of the picture.

Distributed client/server applications may constitute the majority of business and government software by the century's end. Unfortunately, the complexity of client/server applications coupled with somewhat careless quality control is leading to user dissatisfaction and higher-than-anticipated maintenance costs. Both problems can be solved, but they must be brought to the attention of the software community before effective solutions can be deployed. 

Capers Jones is chairman of Software Productivity Research Inc. in Burlington, Mass.

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CLIENT/SERVER SKILLS

Beating the Bushes

In the transitional world of client/server architectures, there may be no single best solution to the daunting problem of finding expert programming help. The best hope is to pick from a patchwork of inside, outside, off-the-shelf and hybrid strategies.

BY JOHN P. MELLO JR.



THE CLIENT/SERVER juggernaut has highlighted skill-set shortages within many IS departments. Solving these shortages is hardly easy, but corporations have adopted a number of coping strategies—sometimes in creative combinations. These strategies range from farming out their entire client/server operations to bolstering resources through a combination of training and the exploitation of powerful software tools and vendor support initiatives.

The enormous growth of client/server computing has caught most organizations unawares, according to Graham Kemp, president of G2 Research Inc., a market-research and consulting firm in Mountain View, Calif., that specializes in systems integration and outsourcing. "We're on the front end of a tidal wave, and there's no stopping it," Kemp says. "The industry—whether it's on the user's side or the vendor's side—hasn't been prepared for it."

But there has always been a shortage of programmers, according to Angela Hey, client/server program manager for INPUT, a market-research firm also in Mountain View. What makes the current situation different,

Hey contends, is a shortage of systems architects—people who understand mainframes, Unix, image servers and personal computers, and who can network all of those pieces together. "An architect who can see the big picture and inspire programmers to program the right pieces is really quite critical," she says.

Further exacerbating the skills shortage is a burr that is nettlesome to all organizations today. "Client/server isn't a [well-defined] technology; it's a moving beast," Kemp says. "There's constant innovation in products and software and architecture." And, according to Frank Dzubeck, president of Communications Network Architects Inc. in Washington, the problem will only get worse over the next four or five years, as object-oriented programming is added to the mix.

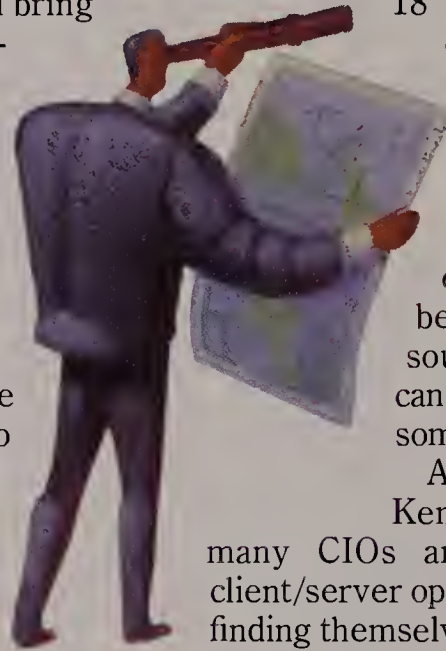
A common recourse for organizations lacking the necessary client/server skills is to pass the buck to a third party, according to Lane Nonnenberg, general manager of the operations services division at Hewlett-Packard Co. in Mountain View. "I think more customers, as they implement client/server systems, are looking at the fact that their internal people already have the skill set to run existing stuff but don't



know about the new stuff; so if you want to get it up and running quickly, you bring in somebody with that expertise," Nonnenberg says. "You bring in people who understand the application area, and you bring in someone who knows how to operate in that environment with that application on it."

The flip side of this approach is to bundle all of a company's legacy-mainframe tasks—support, maintenance and development—and hand them to a third party under a facilities-management contract. Then the organization can hire new people or train existing staff to develop a new architecture based on a client/server model.

SUCH WAS THE CASE at Xerox Corp., of Stamford, Conn., when it inked an outsourcing deal with EDS Corp., of Dallas, worth an estimated \$3.2 billion to \$4.1 billion over 10 years. While EDS runs Xerox's legacy systems, Xerox will invest \$30 million to build a "network-centric" infrastructure. A core team of 250 IS staffers and outside contractors will be involved in the project.



outsourcing benefit. "It's faster to get a third party to do client/server than to hand off your existing operations and then start a process that will take typically 18 months to two years to complete," he explains.

The downside of this, however, is that it often occurs without skills being adequately transferred to in-house employees. But Dzubeck believes that even an outsourced development effort can make time to accommodate some in-house training.

A survey conducted by Kemp's firm indicates that many CIOs are inclined to hand off client/server operations. "Corporations are finding themselves with a client/server environment that they're not familiar with," says Kemp. "The CIOs we had in our focus groups were pretty unanimous about keeping that part of the business under the control of someone else who understood how to operate and manage that environment, and to carry on the [required technical training updates] so that the system doesn't become obsolete in a year."

According to Bob Budnick, director of distributed systems management market support at Integrated Systems Solution Corp., IBM's outsourcing company based in White Plains, N.Y., more and more companies are focusing on their core business and customers. "They look for a technology partner who will provide the skills and infrastructure to enable them to more effectively manage the business."

That's why NatWest Markets, a banking concern in London, outsourced the management of a wide area network in its Pacific region, according to Stephen Coleman, the company's director of IT for capital markets. "The management of a wide area network for a bank is going to be no different than for a computer company like Hewlett-Packard or an oil company like Exxon or a manufacturing company like General Motors," he says.

SOME ORGANIZATIONS that lack the skills to produce the client/server applications they need are turning to canned solutions. "There is a movement toward using industry-available applications from third parties as opposed to building custom

"There is a movement toward using industry-available applications from third parties as opposed to building custom applications from the ground up within the company. Customers are moving toward off-the-shelf applications because they don't have the two years it takes to design and develop an application for an open system."

—LANE NONNENBERG

"What outsourcing a legacy environment does is free up a pool of programmers that you would not have had before," explains Dzubeck. However, as Nonnenberg notes, "The downside is that it takes a lot of time to do that."

An organization looking at outsourcing as a means to meet skill-set shortages must have a clear focus on its horizon. "If you're outsourcing legacy, what you're saying is that you want to build your people to deal with the new technology," says Hugh Ryan, director of new-age architectures at Andersen Consulting in Chicago. "If you're outsourcing client/server applications, you're probably focusing on rapid development."

Kemp agrees that speed will be a likely

applications from the ground up within the company," Nonnenberg says. "Customers are moving toward off-the-shelf applications because they don't have the two years it takes to design and develop an application for an open system."

According to Rick Bergquist, vice president of technology for PeopleSoft, a Walnut Creek, Calif., maker of client/server application-development tools as well as human-resources and financial software packages, organizations sometimes turn to off-the-shelf products to spare themselves the time and expense of developing the specialized expertise needed to write—and maintain—certain kinds of applications from scratch. "For example," says Bergquist, "a payroll system...is a huge undertaking to write. And then there's an ongoing maintenance effort to keep up [with] tax changes and everything else. It's much more cost-efficient to have a vendor who specializes in that... deliver [both] the application and the maintenance."

YET ANOTHER APPROACH to plugging skills gaps is to hire contractors to work alongside in-house personnel. This can be an attractive alternative for companies with a more conservative bent to get their feet wet in client/server development without making a major investment. Short of actually outsourcing, they can get some of outsourcing's skills benefits, along with the added value of having client/server expertise transfer to in-house staff.

This makes economic sense. Organizations have discovered that the costs of client/server migration can ratchet up quickly, according to Jeff Kaplan, director of Dataquest Worldwide Services Group, a market-research firm based in Framingham, Mass. "A company may be apprehensive about the level of investment it wants to make in a client/server system, so it will go about it in a very conservative fashion," he explains. "By not hiring full-time people, by not engaging in an across-the-board contract, it can take a measured approach to the problem."

However, contract players themselves can be an expensive strategy for a company,

notes Richard G. Mills, a management consultant who works closely with the IS group of USF&G, an insurance company based in

"If you're outsourcing legacy, what you're saying is that you want to build your people to deal with the new technology. If you're outsourcing client/server applications, you're probably focusing on rapid development."

—HUGH RYAN

Baltimore. "We have consultants in the place, and we're trying, as rapidly as possible, to transfer the contents of their brains to people who are permanent staff," says Mills. "But consultants tend to be two to three times as costly as permanent staff, so we can't just open a valve and fill this place with hit-the-floor-running kinds of folks who already do this client/server business. That is not economically feasible."

But John Layok, senior manager of client/server development at Hartford Steamboiler Inspection and Insurance Co. in Hartford, Conn., believes that consultants have both modified their fees in recent years and begun to offer more-targeted services. As recently as 1992, says Layok, "when I hired a consultant, I don't even want to mention the dollars I had to spend." Now, he says, consultants' rates are becoming "a little more reasonable."

Powersoft Corp., of Concord, Mass., a vendor of development tools for client/server applications, is offer-

ing a variation of the contract approach. Called Best Practices, the two-week training session guides developers using the company's PowerBuilder product through the application-development process. The goal is to surface as many potential development problems as possible to enable developers to learn the best

available solutions. (The program is the successor to Power-

Start, which until 1993 provided experienced consultants who acted, in effect, as personal trainers for a customer's employees.)

When entering into any contract, it's important to make sure the organization is not



trading its own set of skill deficiencies for the deficiencies of a third party. "If I were outsourcing, I'd require proof that these people know what they're doing," says

"We throw new programmers in the deep end. The best way to get them to learn is to give them something real to do and train them in parallel. But the application shouldn't be mission-critical. If it is, and the programmer doesn't have some expert help doing it, it will turn into a career-critical application for the programmer."

—COLEMAN SISSON

Coleman Sisson, vice president of customer service at Powersoft. "There are a lot of people touting themselves as experts who aren't."

Layok agrees. "You have to be careful interviewing these folks," he says. "Saying you know something isn't the same as actually knowing it." Since Hartford Steamboiler is a Powersoft shop, Layok's consultant screening process is greatly aided by Powersoft's own consultant-certification program. "Not every consultant we have is certified by Powersoft," he says, "but if one is, [then] the interview process becomes a whole lot easier" because a base of knowledge can be assumed.

ACCORDING TO KEMP, one of the most effective techniques for meeting the skill levels demanded by client/server computing is for an organization to dedicate a group within the IS department as its vanguard for developing a client/server environment. That group would then work with a third party to design the system's architecture, write the applications and migrate the organization's information to the new system.

Hartford Steamboiler used this approach. "We had some people in-house who were familiar with [fourth-generation languages], so the transition [wasn't] awful for them," Layok explains. "Then we brought in some consultants to help build our system and train our people."

Graphical-user-interface design turned out to be one area where the expert assistance came in handy, says Layok. "One of the first windows we built would have had 22 buttons on it," he says. "[The consultants] helped us learn about drop-downs and pop-ups and list boxes and the appropriate times to use them."

Using this method, the knowledge gained by the information systems group stays with it when the third party goes home, Kemp says. "That's the bootstrap way of approaching it. It works well because people who were sitting there with obsolete skills are given a brand-new lease on life and a brand-new career."

Kemp contends that another dividend comes through the loyalty built within an organization when employees see an investment being made in their future productivity. "It's a demonstration to employees that the company is not just trying to cut heads...but to upgrade its employees' skills," he says.

At Pacific Gas & Electric Co., in San Luis Obispo, Calif., skills enhancement is done as an ongoing formal program in which a mentor system is used to bring neophytes up to speed on client/server environments. "It's a journeyman approach," says Tom Brake, engineering manager for applied technology services, harking back to the crafts guilds. "In essence," says Brake, "a person works for the mentor"—a fellow staffer who already possesses the skills—"for six months to a year."

In addition, the corporation rotates people through Brake's department from time to time to upgrade their skills. "That person will sit in the shop for about six months," he says. "That's about what it takes for a person to...[begin] writing fairly stable applications for a Fortune 500 company."

NatWest Markets relies on a less-formal method to get new people up to speed in client/server skills. "We throw them in the deep end," Sisson says. "The best way to get them to learn is to give them something real to do and train them in parallel."

However, an organization should be careful about how much reality it forces upon its new programmers. "The application shouldn't be mission-critical," Sisson says. "If it is, and the programmer doesn't have some expert help doing it, it will turn into a career-critical application for the programmer."

Skill shortages may cause some organizations to shy away from facing client/server issues altogether. But that's not a good idea, according to Sisson. "If you don't do it, your users are going to do it anyway," he says. **CIO**

John P. Mello Jr. is a freelance writer based in Woonsocket, R.I.

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APPLICATION DEVELOPMENT

Out-of-this-World Software

The space shuttle's on-board-systems team proves that error-free programming may be tough to achieve, but it isn't rocket science

BY E.B. BAATZ



HURTLING THROUGH space with the Earth floating 5,000 miles below, the space shuttle's on-board computer prepares for the long glide home. A multitude of sensors and instruments feed data into 300 "black boxes" on the ship, controlling speed, heading and trajectory. In the time it takes to read this sentence, the software executes as many as 4 million instructions to analyze that data and guide the spacecraft and her crew back to Earth.

Meanwhile, on the top floor of a steel-and-glass office building a few blocks from the Johnson Space Center in Houston, the tension is palpable. Members of Loral Corp.'s Space Shuttle Primary Avionics Software System team continue their daily exercise of writing, inspecting and testing code. But they all have NASA's in-house cable-television program running in a corner of their computer screens, and as they hunch over their keyboards, the sound of astronaut-to-control-center chatter fills the offices.

Tom Peterson, the software program manager, holds his breath and counts, replaying the computer program in his head as each tick of the clock signals the multiple, complex commands that control the spacecraft's landing. "There are close to a million different parts on the shuttle that all have to work perfectly, not to mention the millions of bits of software code," says Peterson. With no margin of safety, the stakes are high.

Those stakes mean that Peterson's team, which Loral acquired as part of its purchase of IBM's Federal Systems Division in January 1994, must write virtually error-free software. Two hundred and sixty programmers, inspectors, managers and support staff maintain and upgrade the 420,000 lines of computer code that guide and navigate the space shuttle. Treating even the smallest, most benign coding error with life-or-death urgency, these code writers are a shining example at a time when software has taken some nasty hits from embarrassing public failures like the Denver airport debacle.

There are close to a million different parts on the shuttle that all have to work perfectly, not to mention the millions of bits of software code."

—TOM PETERSON



LINDA STOVALL AND TOM PETERSON: A PASSION FOR PERFECTION IS EMBEDDED IN THE LORAL TEAM'S CULTURE. ERRORS—ALTHOUGH CONSIDERED OPPORTUNITIES FOR IMPROVEMENT—ARE ALWAYS PAINFUL.

In its pursuit of perfection, the shuttle project has earned accolades and awards. But the team's greatest triumph may be the "level five" rating bestowed upon it in 1989 by its customer, the National Aeronautics and Space Administration. Level five is the highest rating in the Software Process Capability Maturity Model, created by the Software Engineering Institute (SEI) at Carnegie Mellon University. The model—a system of questionnaires, interviews and benchmarks—assesses a programming team's ability to produce predictable, reliable software. Level one is chaos. Level five is perfect predictability and control. Before 1989, many considered the latter to be a purely academic ideal, with no application in the real world. (See box, Page 43.)

Although the SEI did not officially evaluate the on-board shuttle project (the rating is not given for specific projects but for an entire organization), experts agree that the Loral team has achieved extraordinary results. After touring the project in 1990,

Watts Humphrey, an SEI fellow and the founding father of the software process program, said that the team's "four-step process for defect prevention was particularly impressive and represents a step beyond what we had been considering." Indeed, SEI's level-five criteria have been modified to reflect the success of the shuttle project. (Motorola India Electronic's programming team in Bangalore, India, is the only other organization to have publicly proclaimed itself at level five using the SEI scale, but it has been reluctant to invite the Carnegie Mellon examiners in for a look around.)

THE DRIVE TO PRODUCE perfect software is deeply embedded in the on-board-shuttle group's culture. It is a culture that will be tough for others to emulate, one in which personal pride and responsibility are so important that Peterson must formally sign off on the product and shake the lead astronaut's hand before he or she steps on board the spacecraft.

Such considerations, however, are not all that drive the team's passion for quality software. It is also a matter of maturity, and the lessons of maturity can be learned.

With 20 years of experience, the shuttle-software project is certainly more mature than most programming groups. While the art of computer programming was still young, the shuttle team was already under the gun to invent new ways to monitor and control its software-engineering process. Well before total quality management became popular in American business, the team had a mania for metrics. Errors that emerged from the software-development process—even benign mistakes—were tagged, logged and analyzed. Each error was treated as a red flag pointing to a possible problem in the process itself, which could have ramifications for mission-critical aspects of the software down the road.

"We started out with just high-level metrics," in which errors per lines of source code were tracked, says Ted W. Keller, the project's coordination manager. "But over time we've moved to more measurements earlier and earlier in the life cycle." Under the current system, every step is measured and analyzed. For example, the team measured how many hours were spent preparing for inspection sessions and then correlated the time spent to errors caught. That analysis helped the team determine that at least three hours of prep time and two days' notice prior to inspection would help increase the early detection of errors.

Code writers on the front lines are responsible for establishing their own quality metrics. "The metrics are not decreed by an outside quality expert," says Keller, because when external metrics are imposed, people only reluctantly keep the data, or they may slant the figures to make themselves look good. With the technical line people determining and monitoring their own measurements, fewer problems arise, says Keller. Peer pressure and management review help ensure that accurate and meaningful metrics are maintained.

A S A COUNTERWEIGHT to the increasing empowerment of line workers, the shuttle-software project also has an elaborate management structure that cuts vertically and horizontally, like densely woven fabric. The vertical threads are composed of traditional stovepipe functions such as software development, support

tools and requirements analysis (see related story, Page 48). Horizontal threads, called "control boards," cut across the functions, holding the fabric together by providing a projectwide view of various areas, including discrepancies, computer-facilities coordination, change requests and software tools.

The boards, which are under Keller's direction, provide project-management oversight of the costs and risks associated with each change to the flight software. "We found that each of the line programs could easily become parochial," says Keller. "We needed to evaluate trade-offs for the good of the entire project."

1-2-3-4-5

THE SOFTWARE PROCESS CAPABILITY MATURITY MODEL of the Software Engineering Institute (SEI) at Carnegie Mellon University grades software-programming projects on a five-step scale, from chaos to fully optimized control.

LEVEL 1. The "initial" stage. Here no formal procedures, no cost estimates, no project plans and little senior-management input litter the landscape. No one knows exactly how the software gets written or when development could go off track. As *Scientific American* writer W. Wayt Gibbs described it in his September 1994 article, "Software's Chronic Crisis," this is the level of chaos. Of 261 organizations rated by the SEI to date, 75 percent are stuck at level one.

LEVEL 2. The "repeatable" stage. Here the software-development process is highly dependent on a number of programming stars, without whom the project would be sunk. Some project controls exist, and the team is good at making incremental changes but lousy at making major changes.

LEVEL 3. The "defined" stage. The software process is orderly and institutionalized. If a star code writer got hit by a bus, the project would continue unimpeded because the rest of the team would know enough to be able to take her place.

LEVEL 4. The "managed" stage. The process team keeps metrics on quality and productivity. A process database helps the team analyze errors, parse out resources and plan projects.

LEVEL 5. The "optimized" stage. Data gathering becomes automatic. Defect-cause analysis is rigorous, and defect prevention at the front end of the development process saves time and money during inspection and testing. Because defect analysis is virtually instantaneous, improvements can be fed back into the process as the software code is being written, thereby eliminating repetition of the error.

For more information, call SEI at 412 268-5800. Or to find out more about Loral's rating, call Earl Lee of Loral Space Information Systems at 713 282-7287.

-E.B. Baatz

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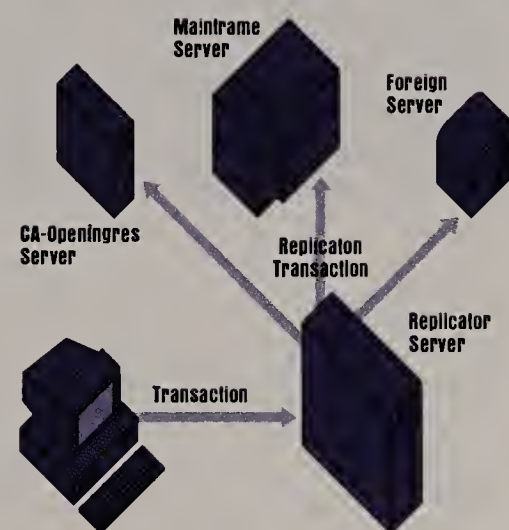
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The Benefits of Better

Raytheon's ascent of the programming-quality scale pays off in hard dollars

WHILE THE COST OF MOVING UP the Capability Maturity Model (CMM) is not trivial, the benefits can be enticing. But top management will need the will, the patience and the upfront investment dollars to reap future rewards.

Raytheon Corp.'s equipment division took the plunge after flunking the CMM test in 1988. The division began pouring \$1 million a year into an initiative to improve its software-development process. From a level-one rating, the division achieved a level three in 1992, and it is now laboring toward level four. The impetus, of course, has been the prospect of more government contracts (the feds are more likely to award a contract to the firm with the higher rating). But Raytheon's software-process investments have also yielded direct, quantifiable benefits.

"We have been able to get management approval to continue this investment because we have measured our return and continue to monitor it over time," says Raymond Dion, the now-retired manager for the company's software engineering initiative at the software systems laboratory in Marlborough, Mass. Using analytical techniques from TQM guru Philip Crosby, Raytheon measures the cost of rework associated with fixing errors, the cost of testing and the cost of preventing errors. This "cost of quality" has led Raytheon to quantify a \$7.70 return for every dollar invested in the initiative. For example, on six projects measured in 1990, the total savings from reduced rework was \$4.48 million, on an investment estimated at \$0.58 million. "These are results that division managers are very interested in," says Gary Wolf, the new manager of the software engineering initiative.

The division also tracks second-tier benefits like improved productivity and on-budget performance, and less-tangible rewards like improved communication, less weekend overtime and better employee morale. But measuring real returns continues to be the best way to keep those investment dollars flowing and upper-management support strong.

-E.B. Baatz

For example, the discrepancy board deals with problem reports that come from internal sources or from any of 200 external NASA user groups and contractors. This board will determine whether to recommend a software fix to NASA's own configuration control board, where the final decision is made. A fix that might create more errors, for instance, may be delayed until a later release of the software.

Of course, with all these controls, metrics and management structures, programmers

sometimes have trouble figuring out who signs off on what. When staff programmer Linda Stovall needed to get approval to buy a new tool, for example, she was confused about which manager to approach.

To offset that confusion and to help document the complex development process for



ANNE MARTT: "WE MAKE A POINT WHEN DISCUSSING ERRORS IN PUBLIC NEVER TO REFER TO AN INDIVIDUAL'S NAME."

new programmers, the systems team is now implementing a Lotus Notes application that will automate the sign-off process. "Now I can track the status of everything we do instead of running around and asking everyone," says Stovall. After a team member signs off on something, the form is automatically passed electronically to the next stop. "I can see how the process flows now instead of just filling out a form and having no idea what happens next." The new groupware tool will eventually allow the programmers to attach detailed notes to each record, instead of just a simple numeric tag.

WITH THE MICROSCOPE constantly trained on finding, tracking and analyzing errors, Loral's shuttle team has to be diligent about avoiding the blame game. "We make a careful point when discussing errors in any public forum never to refer to an individual's name, only to the entire team's name," says Anne Martt,



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The one and only coding error that slipped past the team—back in 1986—is still discussed with heads bowed and arms crossed defensively.

chairwoman for the control board that oversees technical coordinating of schedules and commitments. Oversight analysis, where the team analyzes why an error occurred, “happens behind closed doors without any management present.” The team assesses its own errors and presents its results at a management committee meeting where, again, no individual is targeted. While the group tries to look at errors as opportunities for improvement, “our mistakes are always painful, especially when the entire NASA community is involved,” says Stovall.

That passion for perfection helps explain why the one and only coding error that slipped past the team—back in 1986—is still discussed with heads bowed and arms crossed defensively. The Atlantis crew didn’t notice the flaw during their space shot, but analysts at NASA discovered it afterward by studying the telemetry of the flight. The error was benign, causing the computer to notify the crew about a tolerance calculation on the display screen twice instead of once. “The customer didn’t count it against us,” says Keller, “but it was just luck that the error did not occur in a critical line of code.”

The Analyst Requirement

ONE KEY TO MAKING SOFTWARE ENGINEERING a hard science instead of a murky art: Hire a “requirements analyst.” Yet such positions are frequently understaffed or overlooked entirely in typical corporate development projects.

Loral Corp.’s Space Shuttle Primary Avionics Software System team formally created analyst positions in the early 1980s in order to reduce errors as early as possible in the development process. Their responsibilities include listening to customers and understanding their software requests. “This is a critical job because programmers don’t understand thermodynamics, and the engineer doesn’t understand the implementation issues of software,” says Ted W. Keller, the shuttle-software project’s coordination manager. So, for example, NASA might ask for a particular function to occur every second on the shuttle. But if the requirements analyst knows that 0.96 seconds would be much easier to program, he or she could find out whether this would be acceptable before the code gets written. Fewer changes later in the development cycle mean fewer errors.

The use of requirements analysts has taught the Loral team a home truth: Writing quality software comes down to listening to the customer after all.

-E.B. Baatz

SO, NOW THAT THE OPERATIONS of a level-five software team have been exposed, what does it all mean for the typical CIO? After all, not many organizations face the rigorous standards dictated by space travel. But, Keller says, the level-five assessment has taught the shuttle-project team something that applies to all programming groups: It is possible to make software development predictable. “You can buy this by the yard, depending on how much quality and reliability you need for a particular product,” says Keller.

Essentially, the SEI criteria and rigorous statistical analysis can be used to engineer software at the cost and quality desired. “You might find that it costs four times as much to produce code that has 0.1 errors per thousand lines as compared with 1.0 errors,” says Keller. “For any particular process, you can calculate the cost of quality.” For example, on a project where loss of life was not an issue, NASA wrote its contract for three errors per 1,000 lines of code.

The problem remains, however, that most customers do not specify their desired fault tolerance. To do so, the customer must conduct what John D. Musa, supervisor of software-reliability engineering at AT&T Bell Laboratories, calls an “operational profile.” Simply put, that is a quantitative characterization of exactly how a particular software program will be used, allowing the program’s developers to predetermine reliability requirements. Software-reliability engineering is a state-of-the-art technique that is just now coming into vogue.

The benefits of reduced or predictable errors in code are obvious: lower costs, higher productivity and higher return on investment (see related story, Page 46). Loral’s team has been transferring its knowledge internally, too. “We’ve taken the process we’ve used on the flight code and transferred it to the tools area,” where the team maintains another 1.4 million lines of code for testing, simulations and configuration management, says Peterson. “In the tools area, we had less budget available and fewer people, so I just tailored the process with more flexibility and lower costs.”

With cost controls hitting even this elite team, the goal now is to continue reducing costs, enhancing productivity and determining the next generation of metrics that will keep the space shuttle gliding back to Earth on budget and on time. **CIO**

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END-USER SUPPORT

Sharing Power Safely

If the growing pains of adjusting to end-user empowerment are inevitable, perhaps the suffering can be kept optional.

How best should a CIO provide users with useful tools and applications so that their access to corporate data resources will be productive and not disruptive?

BY MEGAN SANTOSUS



IMAGINE FOR A MOMENT that you're an end user in the finance department of a very large corporation. After six months of promises, you finally get your Windows-based 486 desktop with a color monitor and memory to burn. The machine comes pre-loaded with some whiz-bang applications, but you could really use a program that lets you download weekly sales figures from the mainframe and plug them into a spreadsheet. You know such a program exists because Joe in accounting has one. So, you drop a line to your IS rep explaining what you want and why you need it. A few weeks—and several voice and e-mail messages later—you get a seemingly cryptic response filled with musings about integrity, robustness and scalable architectures. In other words, your request has been denied. But before your anger reaches the boiling point, you think of a solution that seems so obvious you could kick yourself. You pick up the phone, dial an extension, and after the first ring you say, "Hello, Joe...."

This is just the kind of scenario that can make a CIO crazy.

Today's end users want to get their hands on corporate data, period. Whether it resides in local databases, remote servers or a central mainframe just doesn't matter. Try explaining the intricacies of incompatible networks, multiple operating systems, proprietary databases or other facts of client/server life, and their eyes glaze over. If they're not getting what they want from IS, they're likely to try building or buying their own proprietary applications.

Meanwhile, IS departments have to contend with appeasing end users without compromising the integrity of the data or the IT infrastructure of the enterprise. From their point of view, letting proprietary applications spring up throughout the organization can defeat the purpose of distributed computing as well as cause some serious support headaches. After all, if something goes wrong with homegrown applications, the CIO always gets the call. By refusing to empower end users, CIOs could unwittingly create monsters that will later come back to haunt them.

For all of its advantages, client/server technology can intensify any rift that exists between IS and the user community. This is



ALAN LaBATTE: USERS GENERATE THEIR OWN REPORTS, BUT I.S. STILL TELLS THEM WHERE TO FIND THE DATA.

because of client/server's seeming transparency; users see data on their desktops and are unaware—and don't want to know—of the complexity involved in putting it there. For IS groups charged with maintaining a cohesive, enterprisewide architecture, dispersing data to end users—who cannot be bothered with and ultimately are not responsible for such issues as enterprise data integrity and security—may make them understandably nervous.

As a result, the idea of supporting “power” users is not an altogether comfortable pill for many IS people to swallow. Some IS departments try to keep a tight rein on end users by establishing firm control over computing resources while others opt to placate them by handing out some of the tools now available that allow end users to access data

themselves. These include query and reporting tools, executive-information and decision-support systems, and a new class of software products known as data-analysis and exploratory tools.

However, simply throwing tools at end users or, worse, discouraging their empowerment will likely serve no one's needs. Both tactics are a Band-Aid solution to a much greater problem: that IS and end users too often find themselves working as adversaries when it comes to accessing and manipulating data. “There's always been a certain desire in IS departments for a magic bullet,” says Allan R. Frank, the national partner in charge of enabling technologies at KPMG Peat Marwick LLP in Radnor, Pa. “Giving end users a canned query tool isn't going to do it anymore, because accessing

By refusing to empower end users, CIOs could unwittingly create monsters that will later come back to haunt them.



DAVID MACPHERSON:
DEL MONTE'S I.S.
GROUP HAS AVOIDED
FRICTION WITH USERS
BECAUSE RESPONSIBILITIES ARE CLEARLY
DEFINED.

data is only part of the problem."

According to Frank, IS has to be aware of how people manipulate data to make decisions. "When you think about decision making, it's more an act of discovery," he says. "People need to navigate through the data by rotating it, drilling down and viewing it multidimensionally."

In his former job as an economist and end user with a media company located near Boston, Victor J. Maliar was continually frustrated by what he saw as a lack of support from the IS department. He believes that a big part of the problem was that IS primarily offered development services to support downsizing initiatives rather than to help end users do their jobs better. But rather than tailor programs for every individual within an organization, Maliar thinks IS should encourage end users to write their own macros in conjunction with

spreadsheet, word-processing and database programs. "I think it is important," says Maliar, "that money be spent inspiring employees to learn how to use the software packages available to get their jobs done faster and better."

As the vice president of information systems at Uno Restaurants Inc., headquartered in Boston, one of Alan LaBatte's ongoing challenges is finding a better way to make data usable to end users. To help end users extract data from the Cobol-based general-ledger system and download it to their desktops running Windows, LaBatte has implemented Pilot Software Inc.'s Lightship Professional graphical user interface and database server. "The users point and click to manipulate their own copies of the data, so we don't have to worry about integrity." Although users now have the ability to generate their own reports, they

still rely on IS to tell them what data is available and where to find it.

WITH MANY OF THE sophisticated tools that are now available, data access is becoming less of a technical hurdle than it once was. According to John Kish, president and CEO of BBN Software Products Corp., a developer of data-analysis and exploratory tools in Cambridge, Mass., empowering end users will require a shift in attitude among CIOs and their IS departments. "The IS group does a great job of delivering data to people, but not information that those people can use," he says. "Turning data into information is a highly creative process, and IS organizations are not prepared to deal with it." In other words, IS has to stop concentrating on simply delivering data and instead figure out what users are—or could be—doing with it. This, he believes, is one of the keys IS must grasp in order to coexist peacefully with empowered users.

Another trap IS people are prone to fall into is thinking of "end users" as a collective entity with homogeneous requirements and levels of computer literacy. The fact is that end users come in many shapes and sizes, and since they tend to want to look at data in the ways that work best for them, one tool is unlikely to meet the requirements of users in several departments. Those IS people who do not work closely with end users are ill-equipped to select the right tools. "What IS needs to do is find out how end users look at data and then select the right tools to let them build their own applications," says Jeffrey P. Stamen, the president of IRI Software, a Waltham, Mass.-based provider of query and analysis tools. According to Stamen, the rift is most pronounced between IS and end users from sales and marketing. "Marketing people like to perform more ad hoc queries using data from both internal and external sources," he explains, while IS tends to design a system by "finding the requirements, implementing the specs and letting it run." In effect, marketing people want to have the flexibility to look at data in an unlimited number of ways that cannot be defined upfront in a traditional systems-development phase. If allowed to persist, Stamen contends that such cultural differences will cripple any efforts to form a productive relationship between IS and end users.

Having an intermediary who serves as a bridge between IS and the user community is one way to promote a close relationship.

Where the Inmates Run the Asylum

How many stocks can a stock picker pick if a stock picker can't write apps?

A T MUTUAL FUND COMPANY Colonial Management Associates Inc., there are some kinds of application development that only end users can do. "Members of our equity investment group have a very quantitative approach to selecting stocks," explains Joe Archer, the vice president of application development at the Boston-based company. "They build models and execute programs against data we collect in order to come up with a list of 'buys.' Because it's unique to their individual approaches to the stock market, it's not the kind of job I'd like my application developers to conquer."

The equity analysts write their own programs in Fortran and utilize their own data libraries and version control. They also use a variety of analytical programs running on a Digital Equipment Corp. VAX and PCs, and are responsible for maintaining both environments. Archer's group of programmers is responsible for maintaining the centralized relational database where all of Colonial's source data resides.

Colonial also supports many other end users who do much less esoteric kinds of things. A few years ago, the company implemented an executive-information system from Pilot Software that highlighted the need for a formal method of supporting empowered end users. "In the user community, we had a hard time finding an owner for the system," says Archer. "As applications became more sophisticated, we figured we needed one."

A financial-analyst group was founded and assigned ownership of the system. Two analysts have been formally trained to build prototypes of applications with help from programmers. "A sense of partnership has to be part of the relationship," Archer explains, which requires IS people to be sensitive to end users' feelings. "Working with fledgling programmers means we have to be much more tactful in how we deal with them." IS must also acknowledge that developing macros in Lotus or Excel is on the same par as programming in Cobol and C.

Archer has emphasized the importance of standards by requiring all applications to conform with Colonial's style guide. "We have Microsoft Windows-based packages and we want to maintain a consistent look and feel," he says. "We suggest that people document and test their applications and explain why inventing an application that looks different defeats the purpose."

—M. Santosus

At CIGNA's Investment Management division in Bloomfield, Conn., Information Officer Jeff Weinman occupies an unusual position: He heads up the division's IS group and is also an empowered end user in the finan-

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Optimized for Parallel	No	Yes
Consistent Architecture with SP2	No	Yes
Index Scan	No	Yes
Inserts	No	Yes
Selects	Yes	Yes
Updates	No	Yes
Deletes	No	Yes

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"The IS group does a great job of delivering data to people, but not information that those people can use. Turning data into information is a highly creative process, and IS organizations are not prepared to deal with it."

—JOHN KISH

cial group. "As data becomes easier to access," says Weinman, "it's critical to have controls in place by making sure that someone is accountable for specific data elements in the repository. A big part of my job is to make sure that the rest of the managers abide by our controls." CIGNA promotes compliance by having business users take ownership of every piece of data that is entered into the repository. The names and phone numbers of the users who serve as owners accompany each data element, so other users will know whom to contact if they have questions or problems. Access to the data is available to the desktop via CrossTarget, a multidimensional data-analysis tool from Dimensional Insight Inc.

Another key to forging a good working relationship with users is for IS to recognize that power users can in fact be great allies in the organization. By encouraging them to take on some programming and development responsibilities, IS can offload some routine tasks. As a result, IS can devote more time to such pressing issues as implementing new technology and migrating to distributed computing.

"Having power users can be adversarial," says Joe Archer, vice president of application development at Colonial Management Associates Inc. in Boston. "But if you work closely with them and give them the proper training, they can be a tremendous asset." (See related story, Page 53.)



ALLAN R. FRANK: "GIVING END USERS A CANNED QUERY TOOL ISN'T GOING TO DO IT ANYMORE, BECAUSE ACCESSING DATA IS ONLY PART OF THE PROBLEM."

Tool Time

A Representative List of End-User Tools

Query and Reporting Tools

- **Business Objects**
Business Objects Inc.,
Cupertino, Calif.
- **Crystal Reports Pro**
Crystal Services, Vancouver,
British Columbia
- **Focus Reporter**
Information Builders Inc., New York
- **Quest**
Gupta Corp., Menlo Park, Calif.
- **R&R Report Writer**
Concentric Data Systems Inc.,
Westborough, Mass.

Executive-Information Systems and Decision-Support System Tools

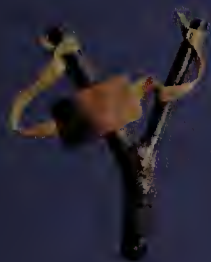
- **Commander EIS**
Comshare Inc., Ann Arbor, Mich.
- **CrossTarget**
Dimensional Insight Inc.,
Burlington, Mass.
- **eSSbase**
Arbor Software Corp.,
Santa Clara, Calif.
- **Forest & Trees**
Trinzic Corp., Palo Alto, Calif.
- **Lightship Professional**
Pilot Software Inc.,
Cambridge, Mass.
- **SAS/EIS Software**
SAS Institute, Cary, N.C.

SOURCE: SOFTWARE PRODUCTIVITY GROUP

Peaceful coexistence is necessary because it is nearly impossible to regain the trust and cooperation of end users once they feel that IS is not giving them what they want. "The genie is already out of the bottle, in that we know there is a real value in putting information at the fingertips of people who make decisions," says Dan Kara, the director of the market intelligence division at the Software Productivity Group in Northboro, Mass. If IS isn't responsive, end users will take it upon themselves to develop their own systems. "The only way IS can stop end users from taking development into their own hands is by adopting draconian measures."



A:



B:



C:



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"Having power users can be adversarial. But if you work closely with them and give them the proper training, they can be a tremendous asset."

—JOE ARCHER

It doesn't always follow that establishing control results in disgruntled and dissatisfied end users, however. Take the situation at Del Monte Foods Inc. in San Francisco. According to CIO and Vice President David A. MacPherson, end users want to access corporate data and reformat it for use as they see fit. But they are not doing their own development and would be discouraged if they tried. "Frankly, I would think that they have better things to do with their time," says MacPherson. "Any system they develop will end up being undocumented and unsupported and could create more problems than value."

End users who want an application are free to contract with outside developers (who handle most of Del Monte's application development), as long as the system abides by the company's standards. "Most of what we have is Windows-based prepackaged software," MacPherson says. "We've had rigorous training on Microsoft products, and we'd like our users to stick with them." A staff of in-house developers and EDS consultants are on hand to work with roughly 3,000 users. According to MacPherson, Del Monte's IS group has avoided friction with users because responsibilities are clearly

defined. "We provide the channel for our users to access the resources they need."

Another way to create a channel for end users is to encourage their participation in prototyping a new system. When Texas Instruments embarked on a corporatewide re-engineering effort two years ago, end users were involved in systems development from the very beginning. "At the rate that businesses are changing, it's very important for users to help specify prototypes," says Wayne Spence, the director of business and strategic services at the company's Dallas headquarters. "Because the knowledge worker is a very large percentage of our population, it's easier for them to do their own development than it is to explain the business to the IS people." It's important to educate end users in the business units about standards and the corporate architecture, says Spence, so that adherence becomes everyone's responsibility. "This ensures that users are involved in the solution process," he says.

Prototyping new tools gives both users and IS an opportunity to put their concerns on the table; users can express their application needs while IS can reinforce an awareness of standards and architecture issues. William Taylor, the vice president of real-estate investment at CIGNA, gave CrossTarget a test drive before the division made a commitment to the system. (Real estate is part of CIGNA's Management Investment division, although Taylor does not work directly with Weinman.) "Before, the systems people accessed the data for us because it was very cumbersome to use," explains Taylor, who manages CIGNA's commercial real-estate mortgage loans.

Even a relatively simple task such as getting the balance on a current loan had required notifying two separate departments; Taylor wanted to find a way to access the data on his own so that he could perform in-depth analyses quickly. He kept "bugging" the systems group, which selected three online analytical-processing tools for evaluation. It was then the users who decided to implement the tool that worked best for them.

By selecting the right software tools and making sure that people are at least aware of the need to abide by certain standards and controls, IS and empowered end users can work in mutually beneficial ways. By joining forces in a common goal, both groups can strive for ways to enhance how their organizations operate. **CIO**



JEFF WEINMAN (LEFT) AND WILLIAM TAYLOR: BUSINESS USERS AT CIGNA TAKE OWNERSHIP OF EVERY PIECE OF DATA ENTERED INTO THE REPOSITORY.

PHOTO BY LANNY NAGLER



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CIO



ROUNDTABLE

Talking About an Evolution

Just about every company today has either switched to client/server or is planning to. Embracing the architecture successfully requires a marked shift not only in the technology involved but also in the way a company plans, develops and implements its systems. Here, a panel of experts discusses what it takes to make it work.

BY MICKEY WILLIAMSON



THESE DAYS, when IS people get together, talk inevitably turns to client/server development. The rush to client/server has been responsible for some of the most significant business gains—and some of the worst disappointments—in the annals of computerdom. Experts agree that the road is full of pitfalls, both while systems are under construction and after they are deployed. But those who navigate the path successfully will find at its end business benefits that can be achieved in no other way.

In order to explore the ins and outs of this most complex of computing architectures, *CIO* assembled a panel of experts for a teleconference and asked them to discuss the is-

sues involved in bringing robust, reliable, business-savvy client/server systems into existence. Present at the virtual roundtable were Jerrold M. Grochow, chief technology officer and director of the Center for Advanced Technologies at American Management Systems Inc. (AMS) in Fairfax, Va.; Ken Orr, principal researcher with The Ken Orr Institute Inc., a business-technology research organization in Topeka, Kan.; Alex Lobba, the former director of product management at Continuous Software Corp. of Irvine, Calif., who now consults for the company; Bo Swanson, manager of systems development at United Behavioral Systems (a specialty company of United HealthCare Corp.) in Minnetonka, Minn.; and Nicholas Zvegintzov, editor of the newsletter *Software Management News*, based in Los Altos, Calif.

CIO: *The term client/server has been used to describe many kinds of systems. How would you define it?*

KEN ORR: People haven't yet realized that client/server is, in many respects, a fad that's masking something very serious—the movement to distributed processing. Client/server is really a way station on the road to server-to-server systems in which the question of who's the client and who's the server is really a question of who makes the first phone call.

BO SWANSON: The definition that fits with the environment at United HealthCare is that it is the separation of our applications into different tiers. The presentation layer, business-logic layer and data-access layer can be on many different kinds of systems. We're preparing for the inevitable change in these tiers in which the presentation layer will probably become voice-based and the data will be located anywhere, not just on a mainframe or midrange server.

CIO: *What is there about developing applications in this environment that is fundamentally different from what we've done in the past?*

JERROLD GROCHOW: One of the first things that people discover is that every client/server project is a systems-integration project. Whether you're talking about hardware, networks or the various layers of software, there are many different components, coming from many different vendors. Unless you're prepared to spend the appropriate amount of time on systems integration—dealing with multiple vendors, having multiple, different components all linked together—there are a lot of shocks in store.

ALEX LOBBA: That is really the crux of the issue. The old notion of a development team is totally uprooted. Instead, we're dealing with a virtual team, one that includes vendors, suppliers, subcontractors, outsourcing groups and development teams within the organization. They need to be coordinated to produce one application that works. The ability to manage and coordinate the workflow of all of these activities, and to make sure that the right versions of all the different components they produce come together, is a key challenge.



GROCHOW



ORR



LOBBA



SWANSON



ZVEGINTZOV

SWANSON: I agree. I do see my work as that of a systems integrator. The pieces that we're putting together for distributed applications come from totally different environments. In the past, traditional mainframe systems satisfied our quality requirements—reliability, availability, maintainability and security—by their simplicity, and how well we understood the environment's limitations and scalability. We don't have a comparable understanding of the client/server environment now. The vendors that we're buying from today didn't collaborate to make sure their products will run together before selling them to us. So now we're the ones having to determine all these new limits and scalability factors.

NICHOLAS ZVEGINTZOV: Not only is there a systems-integration problem, there are also technical issues arising from the fact that processes are interacting with each other. Those issues are an order-of-magnitude harder than simply deciding on the correct operation of a single thread of processing.

ORR: We're entering into a period of maximum risk here. Until now, the momentum of client/server has been carrying us as we learned about the architecture. If things cratered along the way—a half-million-dollar project here, a \$2 million project there—it was a learning experience. We could write it off. But now that we're getting into mission-critical projects, we're going to have some bigger craters. There's a big risk that we will go into these projects without understanding what we're doing. I know of one project in the Midwest where somebody has invested multiple tens of millions, and it may never be completed. All the decisions made sense at the time they were made, in 1989 or 1990, but they don't make a lot of sense now.

The trick is to get insight from people who have done this before, who understand how the pieces fit together—and to get that input early. Once you're committed to certain strategies, it's really hard to go back.

CIO: *People with this kind of experience and skill hardly grow on trees. How do you find the staff to carry out a client/server project?* [See also "Beating the Bushes," Page 32.]



"We must remember that people will have to maintain the systems in the future."
-BO SWANSON

SWANSON: We've had real problems finding people with those skill sets. Traditional mainframe shops are staffed with people whose experience and competence are totally different. Networking skills, in particular, are key in a distributed environment. I've had success finding a lot of the skills needed among Unix vendors or computer makers.

ZVEGINTZOV: I would like to see more respect for the notion that very difficult analytical techniques are required to understand these systems. By contrast, I've got a press release that I framed and put on the wall. It says, "We're announcing a system that enables you to generate client/server systems without any training at all."



GROCHOW: AMS has been in business for 25 years, and we've developed expertise in mainframe systems in several thousand people, so this whole issue of finding and training or retraining them is very important to us. I think it's important to every large IS shop.

We've attacked this in three ways. First is training. Our internal training budget has doubled on a per-capita basis over the last two and a half years. It's not just classroom training. A lot of what we are doing now goes back to a technique that is hundreds of years old—that is, the apprenticeship. The best way to learn these things is to be

involved in a project, but a project that is treated as a learning experience. We have people who are masters and journeymen, and we assign apprentices to them for some period of time with very specific goals to learn these new techniques.

Now that's expensive. And it means that you can't send 50 people for training all at once, because a master might only be able to deal with three or four apprentices at a time. But I really do believe that it's necessary in order to get a thorough understanding of the technology.

Second, we're realizing that there are so many areas of knowledge, so many pieces of software, that it's unlikely that we're going to see a client/server generalist, at least at the detailed-design level. We've always had specialists in this business, but never to the extent that we're seeing them now. We're staffing projects with a core team, then bringing in specific people for some period of time and using those people across many projects. That kind of staffing is not as familiar to IS shops as the more traditional staffing where you put someone on a project and they're on it from beginning to end.

Third, we're recognizing that we need to find better ways for everybody to keep up-to-date on changes in technology. So, we've set up a collaborative work environment based on Lotus's Notes product. The idea is to collect as much knowledge from each of our experiences as we can and make that knowledge available so that if one project solves a problem, then the next project team doesn't have to reinvent the solution.

CIO: *No one so far has mentioned cost savings, yet many CIOs are thinking that the move to client/server will save money. Are they right or wrong?*

GROCHOW: A couple of years ago there was a lot of talk about cost savings. For the most part, though, people were looking only at incremental costs, not doing full costing. They were overlooking the fact that they would have to run parallel operations for a long period of time. When they finally sat down and wondered why IS budgets were going up rather than down, they began to realize that



client/server development was not going to be significantly less costly than non-client/server development. In fact, in some cases it's more costly.

It all depends on what you are trying to accomplish. If you're setting out to reduce costs, then you take one path. But if you're developing client/server systems that will allow end users to do things they couldn't do before, to provide services to customers that you couldn't provide before, then you come up with a very different equation. Because then you're looking at benefits to the business, and that gives you the freedom to look at this as a standard investment decision.

As people move from the early experiments with client/server to replacing or developing new strategic business systems used by thousands of people in a 7-by-24 operation, they're looking at it in a full costing sense, in terms of the benefits they're providing to the business.

CIO: *What kinds of problems are IS organizations experiencing in their client/server projects?*

LOBBA: People who come to us often think in terms of symptoms, rather than the real issues behind those symptoms, and we need to help them identify what the underlying problems are. The symptoms that IS organizations notice are, for example, the fact that projects are late, quality is poor and the end product does not meet the requirements set out at the beginning of the project. For the most part, they have already made their technology choices, and they're realizing the complexity of managing these projects. We suggest that they address the issue of team coordination as a way of dealing with this complexity.

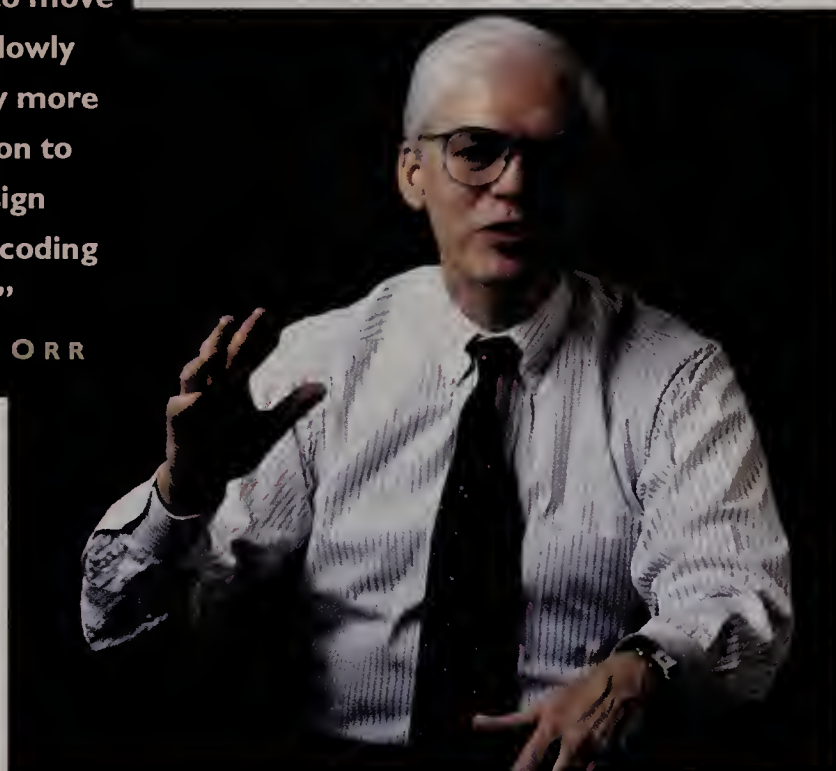
ORR: If you're going to break things into lots of parallel pieces, you really ought to spend a lot more time figuring out how the pieces are going to fit together. That's the thing that worries me most when I hear people say that they are going to get into large-scale, parallel development projects. We don't spend nearly enough time on architecture, and we pay for that later on.

The better you design for distributed

processing, the easier it's going to be to test the system. We lack people and we lack tools, but more than that, we lack architects. The real problem is that we just don't give enough time to analysis and design. I think companies ought to move more slowly and pay more attention to the design before coding begins.

"Companies ought to move more slowly and pay more attention to the design before coding begins."

-KEN ORR



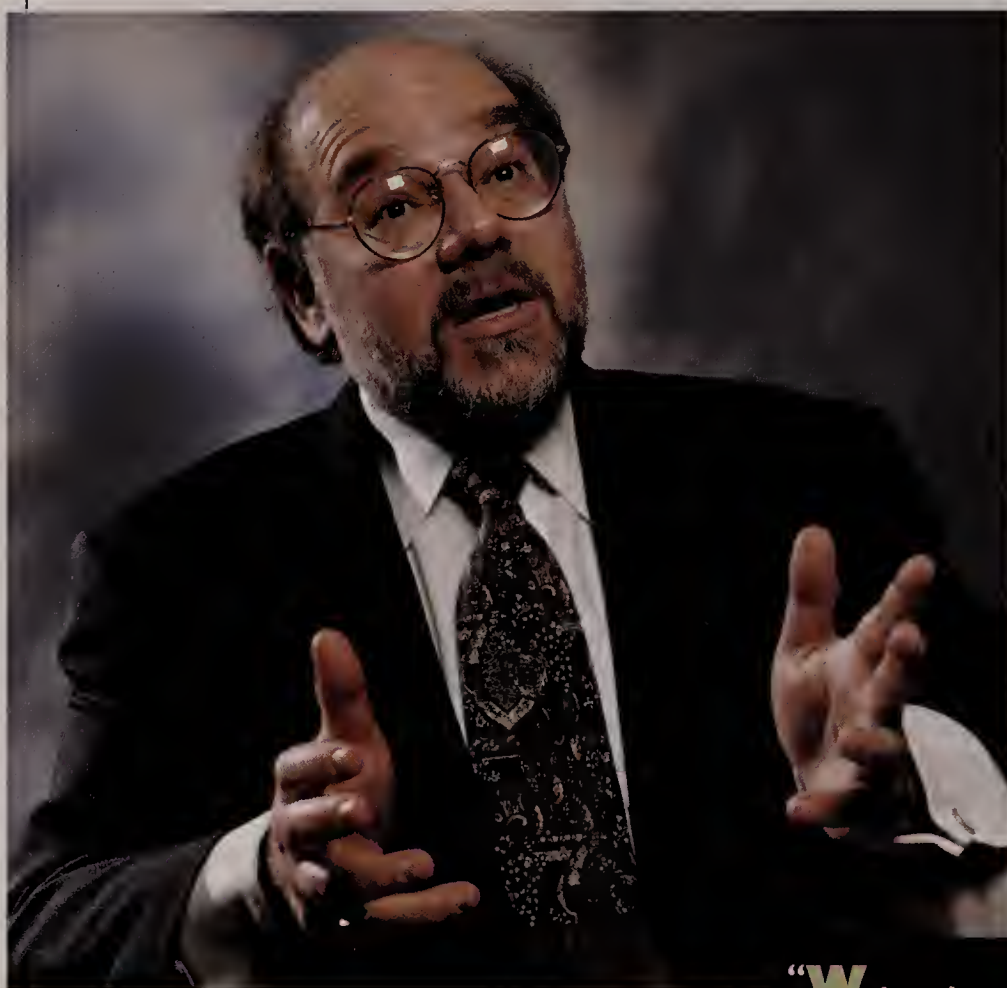
CIO: *Let's turn for a moment to issues related to deployment of systems once they're developed. What types of problems are people experiencing when they put client/server systems into production?*

ORR: Distribution and control problems become considerably more complicated. As we move into distributed systems, we have the problem of keeping everybody together, and central IS groups are learning to behave more and more like software shops, people who do it for money. They're discovering versions, releases and regression testing. They're discovering that the process of getting systems out to distributed locations is a nontrivial one. That is where tools can help a great deal. Most commercial organizations have figured out how to go from test to production, but not on the grand scale that we're now looking at, where we have tens of thousands of PC clients and file servers.

GROCHOW: But, Ken, don't you think that, too, is changing very quickly? Certainly, in the systems that we were putting together a year or two ago, everything related to systems management was home-



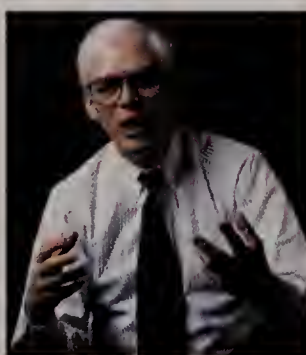
grown and cobbled together. But in the last six or eight months, Computer Associates, Legent, Microsoft and probably half a dozen smaller firms have all come out with their first releases of the systems-management software that is going to do these things in the future. The systems we're



looking forward to installing in the next year or two are going to be able to use some of those new tools. They're not going to be perfect, but they will build on the experience that tool vendors have had, and as soon as they work well, I think we will have the solutions we need.

ORR: There's good news and bad news in that. The good news is that everybody has the same problems, and now the early adopters are in such pain that it's patently clear that there's a big market there. You're seeing the companies that know something about this problem beginning to do something to solve it.

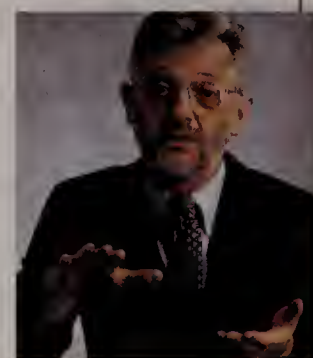
The bad news is that the industry as a whole typically doesn't know about the problem until it gets badly burned. So, even though systems-management tools are beginning to be available, the knowledge that they're absolutely essential, and the knowledge of how to use them, are going to lag badly.



"We've always had specialists in this business, but never to the extent that we're seeing them now."
—JERROLD M. GROCHOW

SWANSON: I look forward to the day when we can be using standards-based tools, but it seems that even then we'll still be running file-transfer protocols and graphical front ends to mainframe applications and using PCs as terminals, because our legacy investments need to interoperate with those of other companies, some of which are frozen at other levels. So, even though we'll have newer ways of doing distributed processing, we'll still have to maintain all those other environments at the same time. It's hard to get rid of these old things.

ZVEGINTZOV: As an industry, our ability to control what we're doing lags behind the complexity that we've installed. We're putting in all kinds of connections between systems without thinking that down the road we need to be able to look into what is happening in such distributed systems.



GROCHOW: Despite quality problems and pitfalls, there are many companies getting business value from developing systems in these new technologies. I just returned from a review of a major object-oriented-development project that I have been involved with over the last year. And I can't tell you the number of meetings we had where there was an awful lot of, shall we say, consternation. But when all was said and done, these people said, "We still did the right thing in doing this project. We will use this technology again." And when we look just at the productivity numbers, despite all of the learning curves and everything else they've gone through, these are still among the highest-productivity projects this company has ever done. And that says to me that we've got a lot more good stuff to look forward to as we get past some of the learning curves and some of the integration curves. Let's not forget that there's a real positive side to this, too.

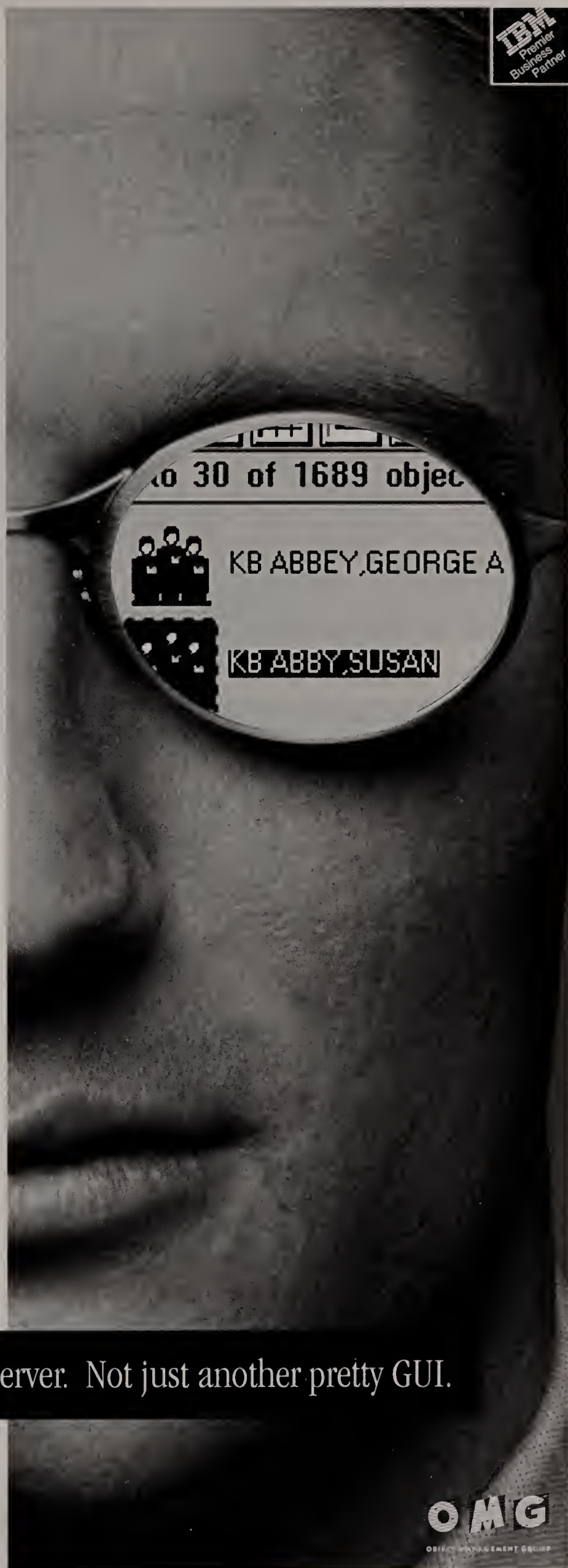
ORR: One thing that's clear is that some of the things we take for granted in client/server—the GUIs and the pop-up screens, for example—have an enormous impact on the usability of the system, the

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—ALEX LOBBA

training load and the error rates. Those are not technology issues; they're business issues.

On the other hand, often we don't know how good the work we've done is for four or five years after it's installed. You can't anticipate what maintenance is going to do to you until you see the technology in operation. You can't do longitudinal studies except over long periods. We're just beginning to see some data on some of these projects, and I'm not sure yet what it's telling us.

GROCHOW: What we've got here is a tremendous compression of the learning curve. Rather than a few early adopters and a big horde of people waiting to see what happens, you've got everybody jumping in all at once. A lot of people have made major commitments to this technology, and they are not going to be stopped by the problems. They're going to find solutions to them.

CIO: *What should people be measuring to determine whether their systems are actually delivering what they are supposed to deliver?*

GROCHOW: The place to start is to ask if the system is delivering benefits to the business. When you set out to develop a new system, it's extremely important to make clear to management the purpose of that system, and to frame that purpose as much as possible in terms of the overall goals of the business.

If you're putting in a new receivables system, then the benefit has to be talked about in terms of reducing the outstanding days of receivables. If it's a customer-service system, you've got to talk about it in terms of measurable improvement to customer service. Some of these things get a little squishy, but more and more in service businesses, people are coming up with measures of improved service.

SWANSON: I think that time to market is really going to be the ultimate measure, providing the same types of business solutions that we had the day before, but within a cleaner, better and speedier framework.



LOBBA: From a technology standpoint, one of the key things that people look at is the number of problems that are reported against a new release of a particular application. Then, within the development organization, you look at your accuracy in predicting how long a project will take, then reduce the number of errors and simplify the maintenance effort.

CIO: *What quality issues are people grappling with in their deployed client/server systems?*

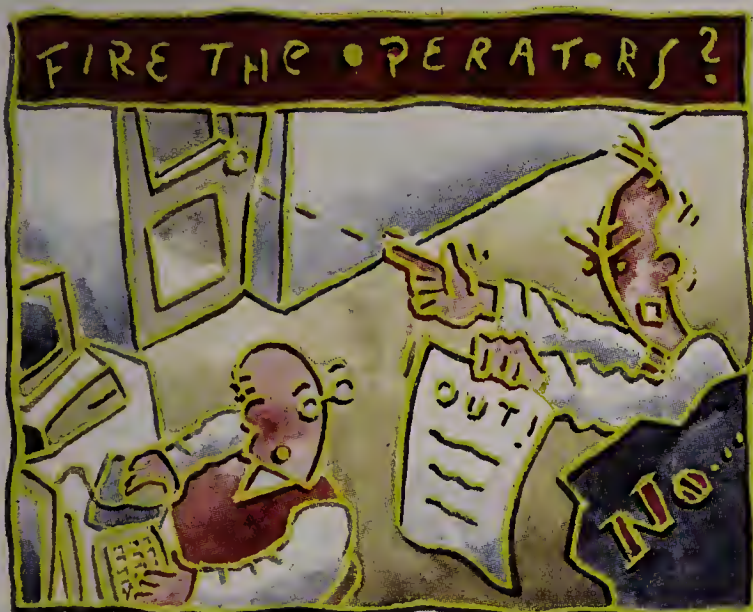
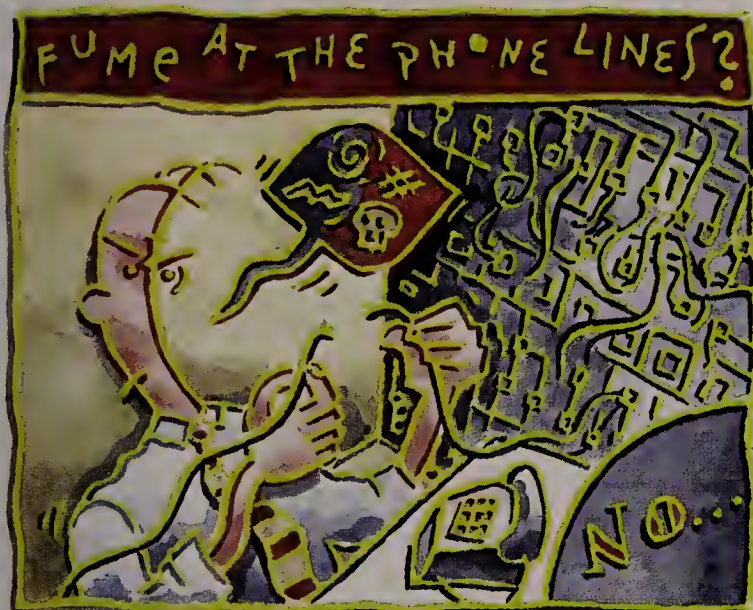
SWANSON: The key thing for us is trying to replicate data in multiple environments for the sake of performance. Someone has to be responsible for synchronizing this data in two or more places. We're looking more and more for packages to purchase that will perform these functions for us. And we're seeing some of this coming from database vendors today.

ZVEGINTZOV: There are mathematical theorems that teach us about the reliability with which you can update distributed data.

Here again, I see press releases that say, "We've solved the distributed-data updating problem," and I am compelled to be skeptical, because I think there are real-world mathematical limitations to this. I would like to see that kind of



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question resolved. I believe we're showing unreasonable optimism about things that might be impossible to achieve.

ORR: There is some question about whether or not that's even a goal. By and large, we can't guarantee the network, but we still have to operate. What would be really nice is if we had true network management, which we don't. We've got some fairly elegant solutions for single-vendor environments; the problem is, we don't have any single-vendor environments. At least we ought to be able to let people look at what



they've got across different platforms and try to make some sense out of it. That's a much more complicated problem even than it looks at first glance.

CIO: *What kinds of maintenance problems should we be prepared to see in years hence?*

ZVEGINTZOV: Our historical experience has been that the worst maintenance situation is to be the only group using some language that was the brilliant idea of a group that's now gone out of existence. A piece of advice I give is always to use the technology that most people will use in the future. Otherwise, you're getting your organization into serious problems.

The right language, unfortunately, is not necessarily the best and most expressive one in the universe. It's the one that most people use, that has the most vendor support and the most tool support. I would say that a bad piece of Cobol may be a whole lot better as an environment for future maintenance than a wonderful piece of Algol 68.

SWANSON: I have a production environment today that consists of many different languages. I think one overriding factor is that, regardless of the environment and the language, we do need to apply standards, and we do need simplicity in the environment—well-defined interfaces, well-understood languages and environments—and we must remember that people will have to maintain them in the future.

"I believe we're showing unreasonable optimism about things that might be impossible to achieve."

—NICHOLAS
ZVEGINTZOV



ORR: The most important factor in all of this is, are we doing the right business things, and are we going to be agile enough to survive in the future? The real secret to success is the ability of information systems to change rapidly. And that's the one thing we know that our old legacy systems can't do.

GROCHOW: One thing should be clear to everybody: We are not just making a transition from one style of computing to another. We have entered an era of ever-constant change in our computing styles and in the technologies that we use. The most important success factor for organizations—at least as regards information systems, and probably as regards business processes too—is going to be having organizations that can tolerate much more change over long periods of time than they ever did before. And that is going to be tough. **CIO**



Mickey Williamson is a technical journalist based in Warwick, Mass. Her Internet address is qwertygroup@mcimail.com.



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The Network Toolbox

The growth in both size and complexity of enterprisewide client/server networks increases the need for a comprehensive and uniform set of management tools

BY JOHN EDWARDS

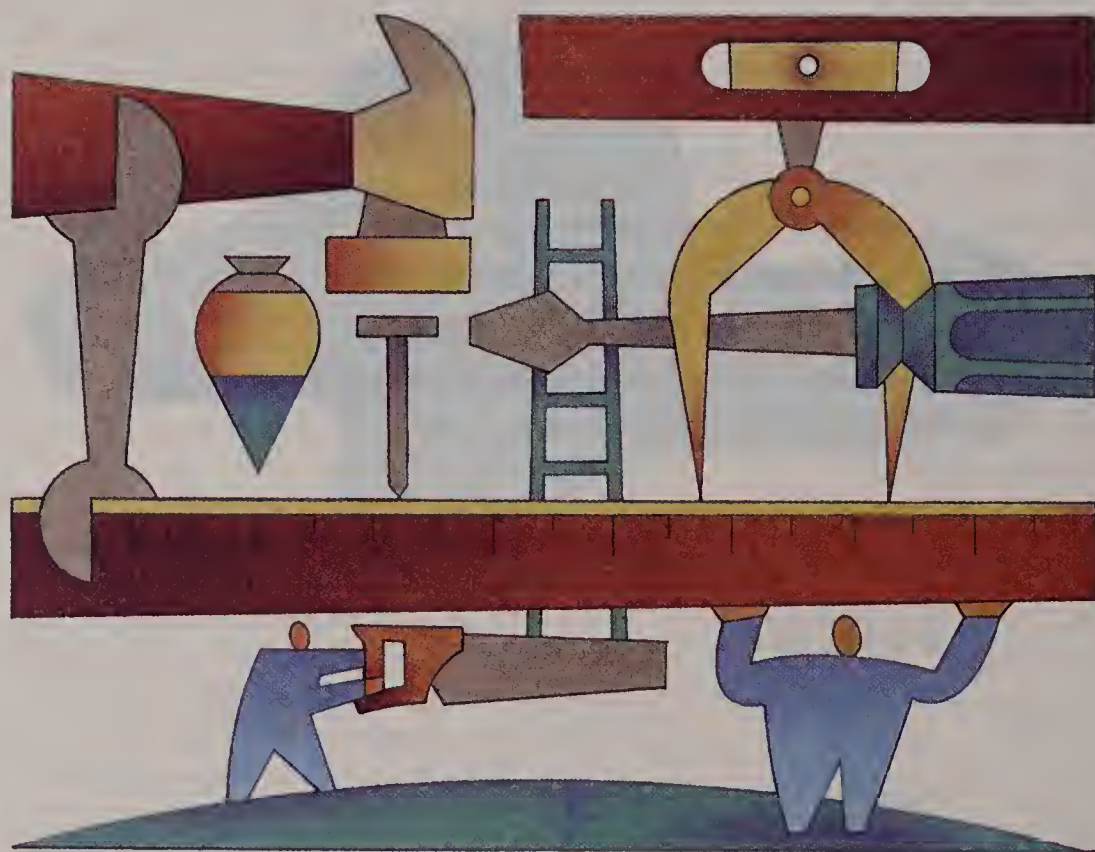
The enterprise network is now the key element in the computing environments of many organizations. As critical applications that used to run on multiple platforms are transferred to the network, organizations are forced to cope with management tools from a wide range of vendors designed to cover a mind-numbing array of tasks. It's enough to make one long for the comparative simplicity of a more restricted world.

The key components of the management toolbox are inventory and audit, metering and license management, software distribution, help desk/problem resolution, traffic monitoring and integrated network management, according to a recent study by Real Decisions, a subsidiary of the Gartner Group, a market-research firm in Stamford, Conn. The exact type of management tools an organization will find useful depends on its own particular needs and the size and scope of its network.

Platform vendors and independent software vendors offering comprehensive across-the-board solutions stand out as the clear leaders in this market, according to Glenn Gabriel Ben-Yosef, a senior analyst with the Yankee Group, a market-research company headquartered in Boston. "In larger, mission-critical networks, you're most likely going to see [Hewlett-Packard's] HP OpenView and IBM's NetView/6000 being used," Ben-Yosef says. In smaller organizations and workgroups with 20 or fewer workstations, Novell's NetWare Management System (NMS) and ACC Systems' network-management products are common choices from among a wide variety of integrated products. Cabletron Spectrum is used in both small and large environments, he says.

While platform vendors and makers of integrated management solutions claim that their products can handle most if not all routine management tasks, the market continues to support a legion of vendors that provide more-narrowly defined solutions. Products are proliferating in such areas as security, help-desk support, traffic monitoring and specific vertical-market needs.

One type of management tool that's attracting a great deal of industry attention is electronic software distribution, which simplifies and automates the complex tasks of distributing, upgrading and installing software across a range of workstations and servers. "People are finding out that getting software to their PCs and installed correctly is costing more than the actual software itself," says Yogesh Gupta, senior vice president of system management at Computer Associates International Inc. (The Islandia, N.Y.-based company's CA-Unicenter integrated



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management package provides software-distribution capabilities.)

This aspect of network management has become a major factor in reducing deployment, operation and support costs, according to James Herman, vice president of Boston-based Northeast Consulting Resources Inc. "There are so many intelligent devices with complex software, all of which are changing all the time," he observes in a recent report. "Every desktop has to be managed, as [do] a growing number of servers and network elements. Yet each desktop is a little different from every other."

Some tools combine software distribution with other functions. Enterprise Desktop Manager, from Novadigm Inc. of Mahwah, N.J., automatically configures desktop software whenever system hardware changes, and it integrates security, asset and software-change/configuration management across LANs and WANs. DistribuLink, from Legent Corp. of Herndon, Va., offers multiplatform software distribution from a mainframe.

The overall management-tools field is maturing unevenly, with some product families improving in performance and usability more rapidly than others, according to Mitch Kramer, a consulting editor for the Patricia Seybold Group, a Boston-based company that specializes in research on the distributed-computing market. "The strongest areas are backup-and-restore and software distribution," he says. "The weaker areas are things like automated operation, performance management and analysis." Kramer notes that the performance-management area is particularly wobbly because the instruments that enable users to measure and analyze network operations aren't yet fully available.

Computer Associates' Gupta sees a parallel between the current management-tools market and the database market of 10 or 15 years ago. Management used to buy database environments in separate pieces—an application-development language,

a query language, tools for transaction management, recovery and so on. "They would try to do the integration themselves and had lots of headaches," he says. "Today you go out and buy a relational database like Ingres, Oracle or whatever, and it has all the pieces and all the functionality in it." Within the next five years, Gupta expects to see management tools that provide seamless interoperability. "What we're headed toward is a multivendor solution that works as if it were one product."

The Yankee Group's Ben-Yosef is not so sure. While the field is beginning to show signs of consolidation, he doesn't believe that a single vendor can provide all of the management tools needed by an organization. "A major vendor is probably going to provide the platform and a couple of the APIs [application program interfaces], and other vendors are going to write applications that fit into that overall platform."

Independent vendors will continue to play a major role in the management-tools market in the years to come, Kramer agrees. Compatibility with the platforms provided by the industry's largest players will help smooth the way for users acquiring new or updated tools. "Compatibility isn't an issue," he says. "The fact that there are separate tools for separate products and separate functions is really the way that it's got to be."

But while incompatibility isn't seen as a major problem, standardization and general ease of use are of major concern to users. The field still has a long way to go before network administrators can breathe a sigh of relief, according to Ben-Yosef. "Network-manager burn-out is a phenomenon—it's almost like tennis elbow in this industry," he says. Besides providing continuity and a high level of service to end users, standard, easy-to-use tools would help organizations deal with their staffing problems, he observes. "Your support staff grows and shrinks according to the activity of your network. It would be nice to have net-

work management standardized so that you can actually get folks in who know how to use the tools."

A major player in the move toward standardization is the Desktop Management Task Force (DMTF), which is currently organizing hardware and software vendors and others in the management-tools field.

Software-Distribution Market Leaders

Enterprise Market Segment

Enterprise Desktop Manager (EDM)

Novadigm Inc.

AM:PM

Tangram Enterprise Solutions

DistribuLink/MVS

Legent Corp.

Departmental Market Segment

DistribuLink/Unix

Legent Corp.

Norton Administrator for Networks

Symantec Corp.

NetWare Navigator

Novell Inc.

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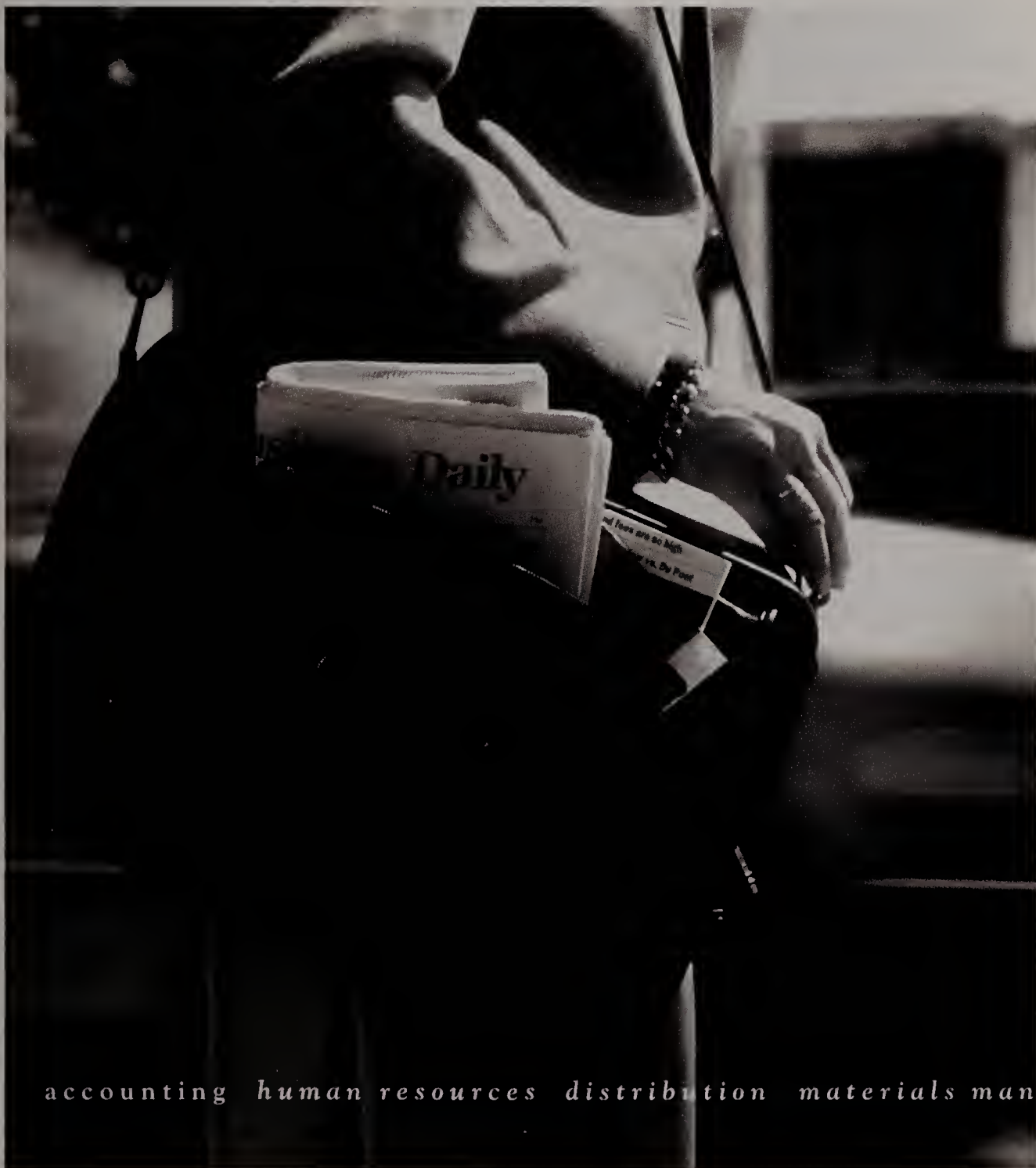
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The Hillsboro, Ore.-based organization's goal is to develop a strategy and ultimately a standard by which all products will be manufactured and managed. But Albion Fitzgerald, Novadigm's chairman and chief technology officer, doubts that any industry group will have much of an impact. Rather, there will have to be a major shift in technology, perhaps driven by object-oriented techniques

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and other leading-edge approaches, before management tools will become truly standardized, he says.

In the long run, the biggest factor hindering the widespread use of management tools may be psychological rather than technical. According to Gale Meyer, IBM's manager of distributed platform products in Research Triangle Park, N.C., management tools often take a back seat to flashier operational technologies that are more impressive to corporate higher-ups. Combine this mind-set with the complexity of the management-tools market and the fear and uncertainty generated by any emerging technology, and it turns out that many organizations ultimately rely on disaster-recovery procedures instead of management tools to fix problems in their enterprise networks.

But if for no other reason than to control costs, all organizations will eventually be forced to embrace management tools, according to Meyer. It can cost more than twice as much to support a group of client/server users than to maintain a group of users working on terminals that access centralized hosts, she says. Management tools help rein in costs, primarily because the wide range of complex software from different vendors found in today's enterprise client/server environments can cause management expenses to quickly spiral out of control. "In the past, organizations could afford to hire staffers whose sole job was to monitor and repair system problems," she says. "Today, given the complexity of the client/server environment, that just isn't possible anymore."

Although it may be tempting to simply leap onto the management-tools bandwagon, Glenn Schwartz, director of distributed technologies for Rye Brook, N.Y.-based network integrator ENTEX

Information Services Inc., warns against trying to implement management capabilities by immediately tearing apart an existing system and consolidating and centralizing network operation. "It will cost an absolute fortune, and the end-user environment will perceive a loss of control and customization," he says.

Divergent Models

Traditional Network Management

- Supports a single platform
- Requires a homogeneous network
- Targets servers for management
- Runs single management applications
- Has a small workgroup of users
- Has a single interface to support
- Manages thousands of resources

Enterprise Client/Server Management

- Supports multiple distributed platforms
- Allows heterogeneous network configurations
- Is client-sensitive and server-sensitive
- Runs integrated management applications
- Has thousands of users/workgroups
- Has multiple interfaces to support
- Manages millions of resources
- Uses object-oriented techniques

SOURCE: NOVADIGM INC.

Schwartz recommends an incremental, three-step approach. "Starting through an audit process, stabilize the environment by upgrading and standardizing the physical and logical systems and network components." The second step is to migrate to a set of standard systems-management processes and start specializing your network and systems-support workers. Assign senior-level staff to the task of supporting a larger base of client/server tools and shift junior workers to administrative functions. "The third step is to consolidate. That's where you begin to leverage your resources across the different LANs and start

to provide more proactive monitoring and alert processes."

Organizations should carefully examine the size of the environment before making an attempt to implement enterprisewide management. "Large-scale technology may be overkill to an organization with a 50-foot network," Fitzgerald says.

"It's really a question of having the right kind of perspective about where your organization fits in."

What will the future bring? Ben-Yosef sees the management-tools field broadening over the next several years to encompass, among other tasks, network-modeling support (see "Making Your Net Work," *CIO*, Sept. 15, 1994). "This will allow networks to become more self-healing and proactive in dealing with problems," he says. Gupta predicts that the market will eventually incorporate a wide range of currently separate areas. "The field is headed toward a world where people will buy enterprise-management solutions that cover the network, the systems, databases and applications."

The management-tools field is undergoing a period of rapid evolution, says Novadigm's Fitzgerald. In the years ahead, he expects to see new tools emerging and

shakeouts and consolidations taking place, with organizations continuing to rely on compatible tools from numerous vendors. "The management toolset of the future will be heterogeneous and will keep moving as rapidly as the technology," he says. Vendors and customers both need to take a long-term view. "What's important is looking at the problem not through the lens of the solutions that people already have but through the lens of what's needed, so we can figure out the solutions that people should really have." **CIO**

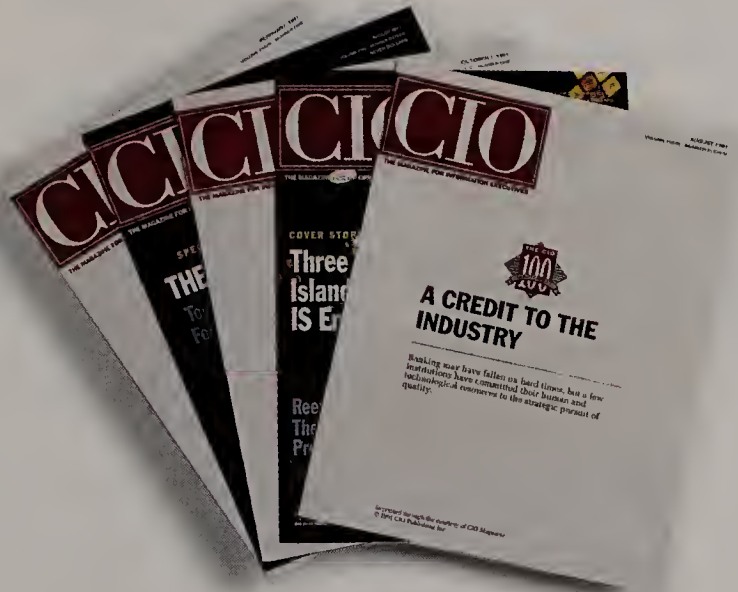
John Edwards is a freelance writer based in Mt. Laurel, N.J.



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CIO Communications Inc.
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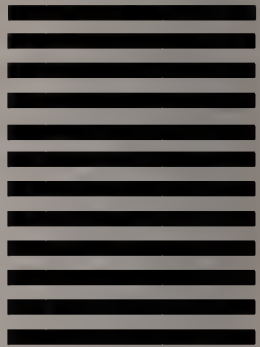
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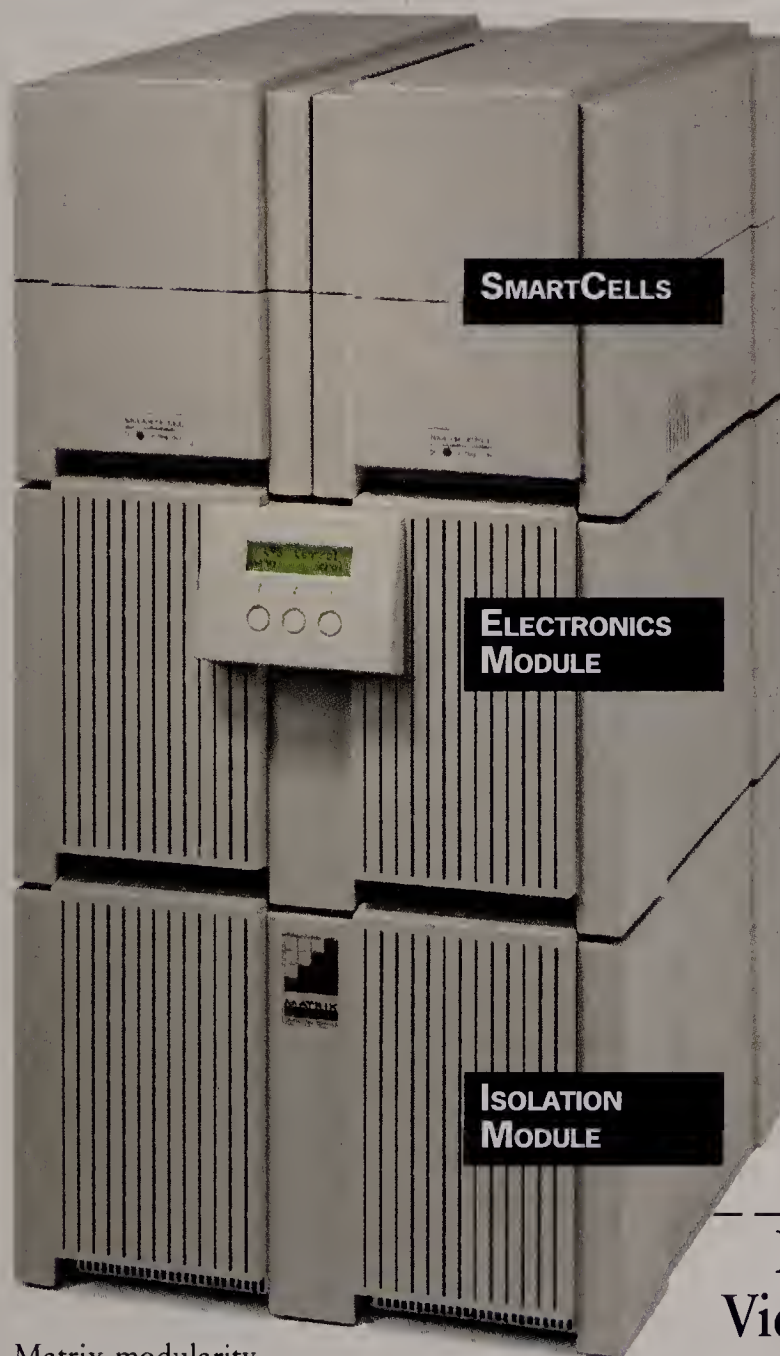
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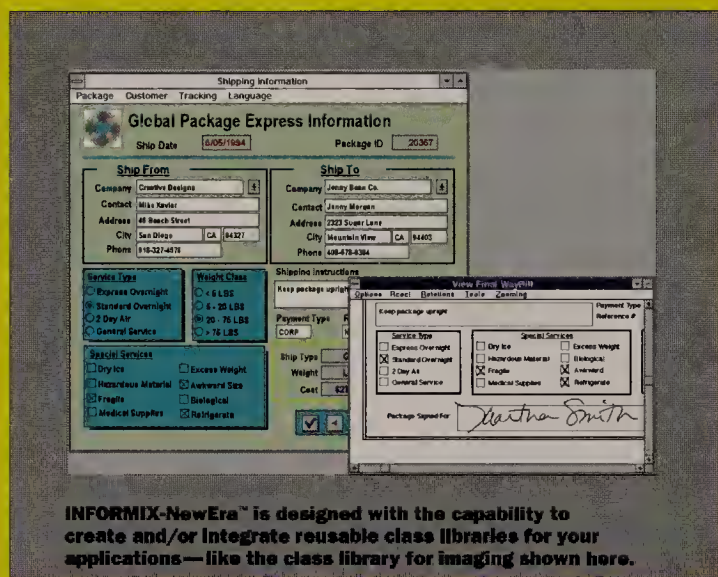
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